BEGA220A

USER MANUAL (PRELIMINARY)

ARM 9 CPU,7” 800X480 TFT with Touch Panel, Wi-Fi, 10/100Mbps Ethernet, RS232/485/422,Audio,SD/MMC, WINCE OS

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History of Version

Version	Contents	Date	Note
01	NEW VERSION	2010/04/30	SPEC.

C O N T E N T S

Chapter1 General Information

1.1 介紹
1.1.1 包裝清單
1.1.2 外觀介紹
1.2 規格
1.2.1 系統方塊圖
1.2.2 主機規格
1.2.3 Wi-Fi 規格
1.3 機構
1.3.1 主機機構尺寸

Chapter2 BEGA220A 安裝

2.1 電源安裝
2.2 SD/MMC Card 使用方法
2.3 Host USB 使用方法
2.4 有線網路安裝設定
2.5 Wi-Fi 安裝設定
2.6 Communication Bus 使用方法
2.6.1 Communication Bus 腳位定義
2.6.2 Serial Port Test
2.6.2.1 Serial Port 安裝
2.6.2.2 Serial Port 測試步驟
2.6.3 Device USB 安裝
2.6.4 Speaker 安裝
2.7 ADC_GPIO Bus 使用方法
2.7.1 ADC_GPIO Bus 腳位定義
2.7.2 GPIO 測試
2.7.3 ADC 測試
2.7.3.1 ADC 測試線路接法
2.7.3.2 ADC 測試步驟

Chapter3 BEGA220A Programming Guide

3.1 Transfer File Between BEGA220A and PC
3.1.1 Connect PC and BEGA220A
3.1.2 Transfer File
3.2 Programming for BEGA220A
3.2.1 Setup Development Environment
3.2.2 Create New Project
3.3 Serial Port Control
3.3.1 Overview
3.3.2 Serial Port Control-CSerialPort Class
4.3.2.1 Basic concept of class CSerialPort
4.3.2.2 Member function of class CSerialPort
4.3.2.3 How to catch the receive message
3.3.3 Example Code
3.4 GPIO Control
3.4.1 How to Control GPIO for BEGA220A
3.4.2 GPIO Control Function for BEGA220A
3.4.3 Definition of GPIO Index
3.5 A/D Converter and Backlight Adjustment
3.5.1 Overview
3.5.2 Control Function of A/D Converter
3.5.3 Function about Backlight Adjustment

Chapter 1 General Information

摘要

這章節提供 **BEGA220A** 的基本資訊

包含部份:

1.1 介紹

1.2 規格

1.3 機構

1.1 INTRODUCE

Order Information

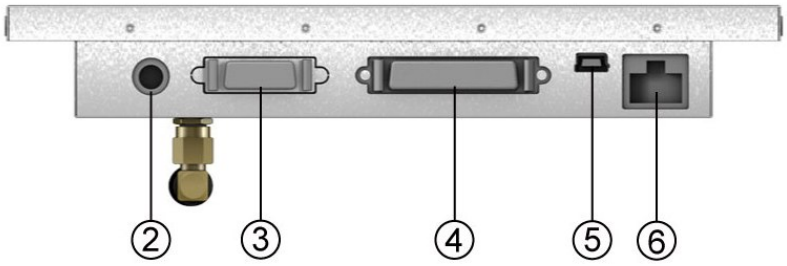
Part No.	RS-485	RS-422	WLAN	20 PIN EXT BUS(IOX12,ADCX6)
BEGA220A	☆			
BEGA220A1	☆		☆	
BEGA220A2	☆			☆
BEGA220A3	☆		☆	☆
BEGA220A4		☆		
BEGA220A5		☆	☆	
BEGA220A6		☆		☆
BEGA220A7		☆	☆	☆

1.1.1 PACKAGE LIST

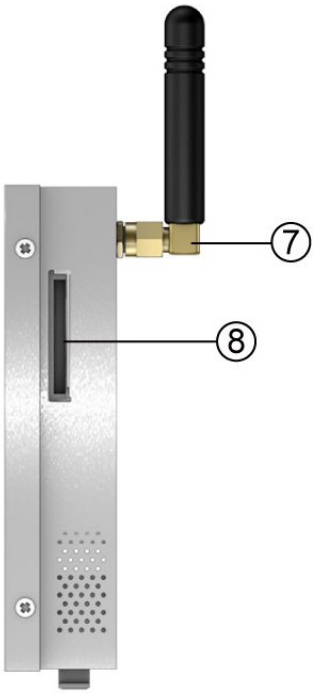
- **BEGA220A**
- **Female USB to mini USB cable with 20cm length (CB04P201LC01$)**
- **220 communication cable with 3M 40 pin connector and length100cm(CB40P1000LC01$)(only on sample stage)**
- **CD for user manual and ulitity software**

1.1.2 APPEARANCE

NO.	ITEM	DESCRIPTION
1	Touch panel	To operate WinCE system.



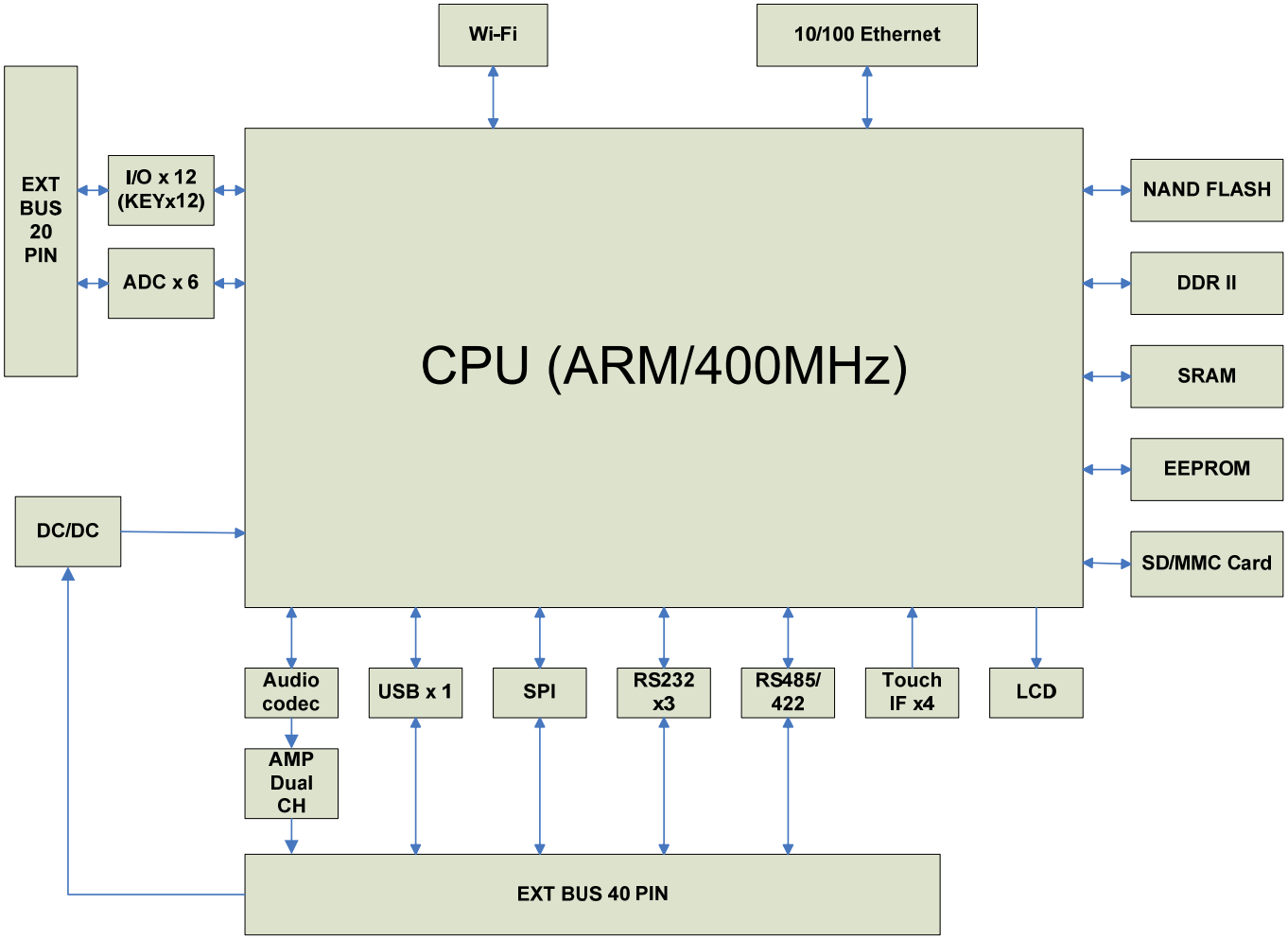
NO.	ITEM	DESCRIPTION
2	DC Jack	DC Plug: φ 2.5mm Power: 12V/3A
3	ADC_GPIO Bus	GPIOx12, ADCx6。
4	Communication Bus	SPI x1, Device USB, RS232x3, RS488/422x1(Option)
5	Host-USB	USB mouse, USB keyboard…etc.
6	RJ-45	Internet



NO.	ITEM	DESCRIPTION
7	WiFi antenna socket	For WiFi antenna
8	SD Card	SD or MMC Card (Max. 4GB)

1.2 Specification

1.2.1 System functional blocks

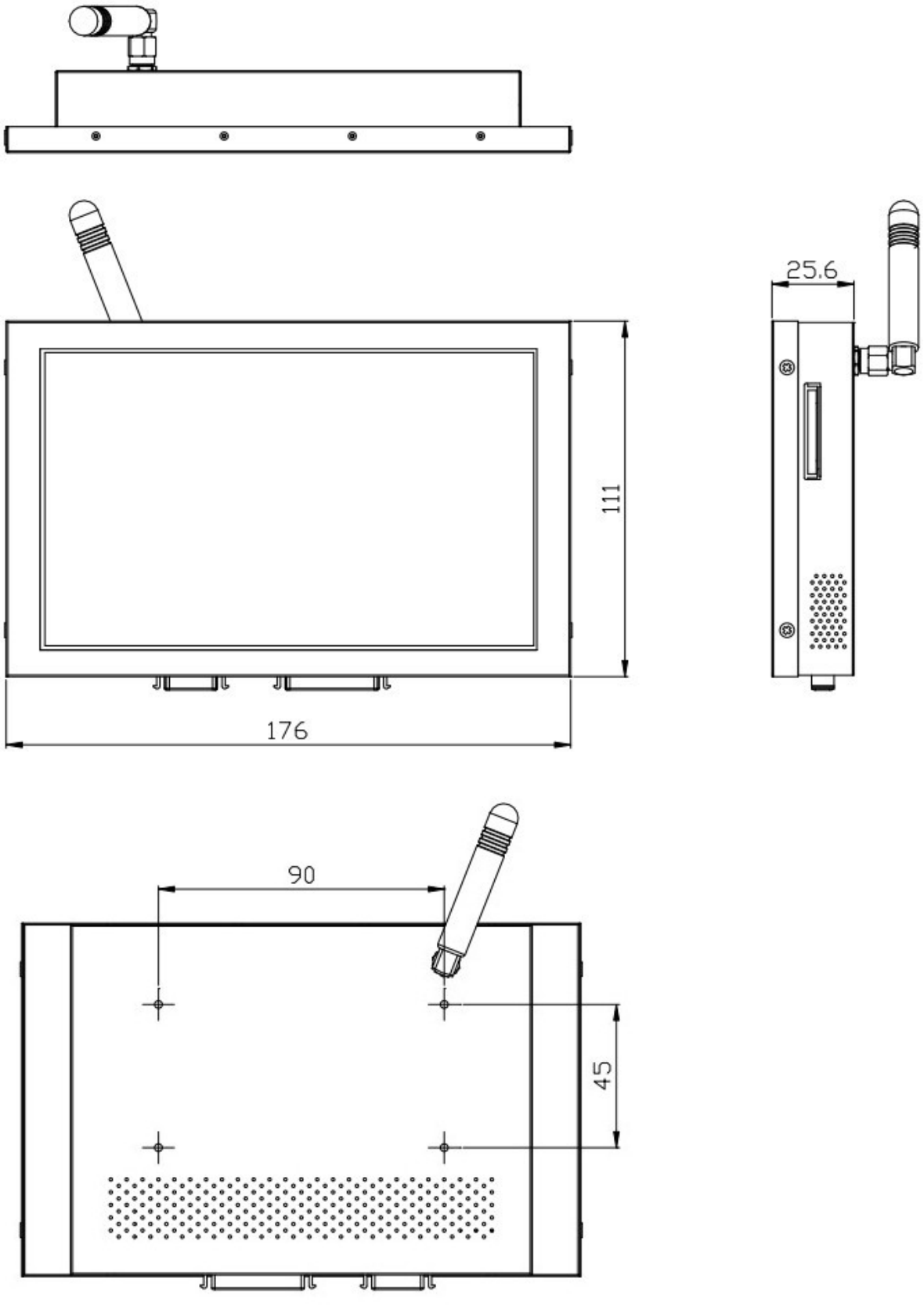


1.2.2 System Specifications

Parameter	Specification
CPU	◆ Samsung S3C2416X 400MHz ◆ 32 bit RISC architecture ARM926EJ CPU core
System Memory	◆ 16-bit 64MB/133MHz DDR2 memory ◆ 512K Byte SRAM
Storage Device	◆ 2GB NAND Flash
Series Port	◆ 2 wire RS232 x 3 ◆ Isolated RS485/422 x1(Option) ◆ SPI x1(Option)
USB	◆ 1x USB device (USB2.0) ◆ 1XUSB host (USB1.0)
GPIO	Support programmable 12 x IO sharing with Key board interface
ADC	Support 6 x channel 12 bit high speed A/D converter
LAN	High performance 16-bit 10/100 Ethernet controller
Audio	Dual channels 2 watts speaker output
Wi-Fi	IEEE 802.11b/g,Wi-Fi compliant
OS	◆ WinCE 5.0(default)
LCD Size	7” TFT LCD
LCD Resolution	800x480
LCD Brightness	400 cd/m^2
Power Supply	DC9V~DC28V
Operating Temperature	-20℃ ~ +70℃

1.3 Mechanical specifications

1.3.1 Mechanical specifications of module



Chapter 2 BEGA220A 安裝測試

摘要

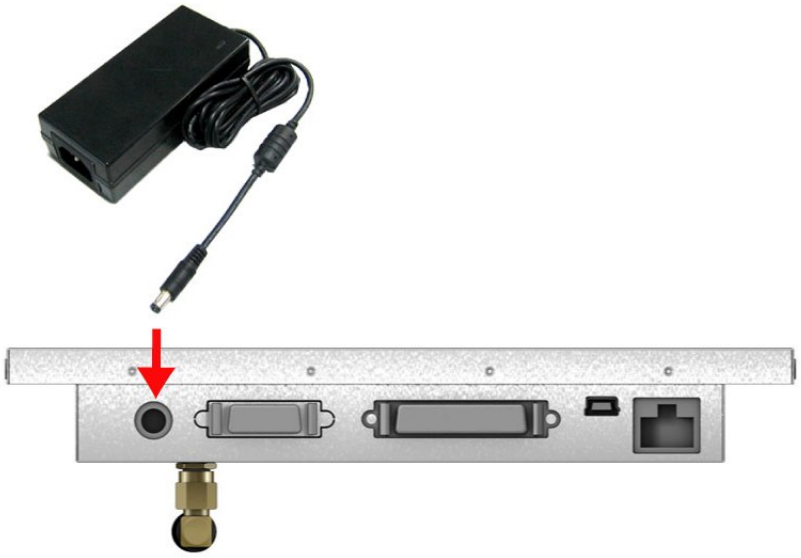
這章節提供 **BEGA220A** 的硬體安裝資訊

包含部份:

2.1 電源安裝
2.2 SD/MMC Card 使用方法
2.3 Host USB 使用方法
2.4 有線網路安裝設定
2.5 Wi-Fi 安裝設定
2.6 Communication Bus 使用方法
2.7 ADC_GPIO Bus 使用方法

2.1 Connect power

Use a DC adaptor of φ2.5 / DC12V/3A into the DC jack and contact with a power of 110/200V AC to socket. After connection is done, BEGA220A will boot up.

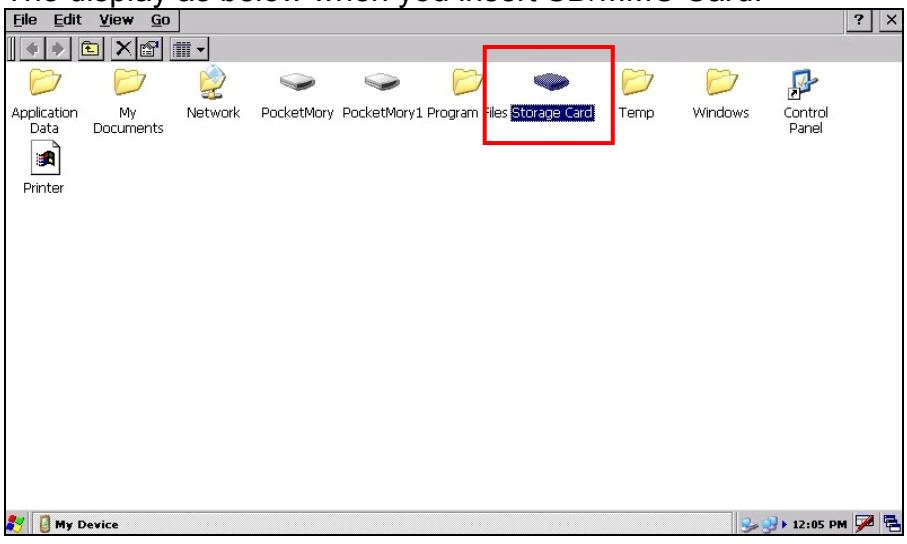


DC Plug_in φ2.5

2.2 SD/MMC Card

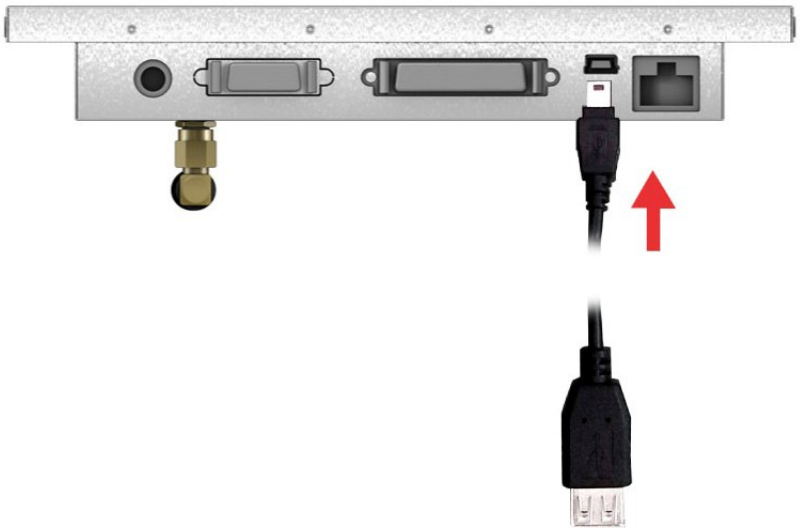
As shown in the following photo, plug in the SD/MMC card. To remove a SD/MMC card, push on the SD card to release it.

The display as below when you insert SD/MMC Card:



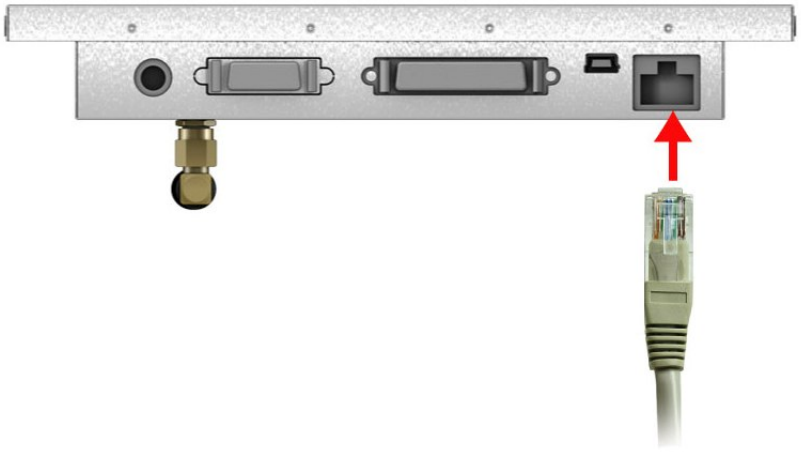
2.3 Host USB

Use a trans. line to transfer MINI USB to USB port.

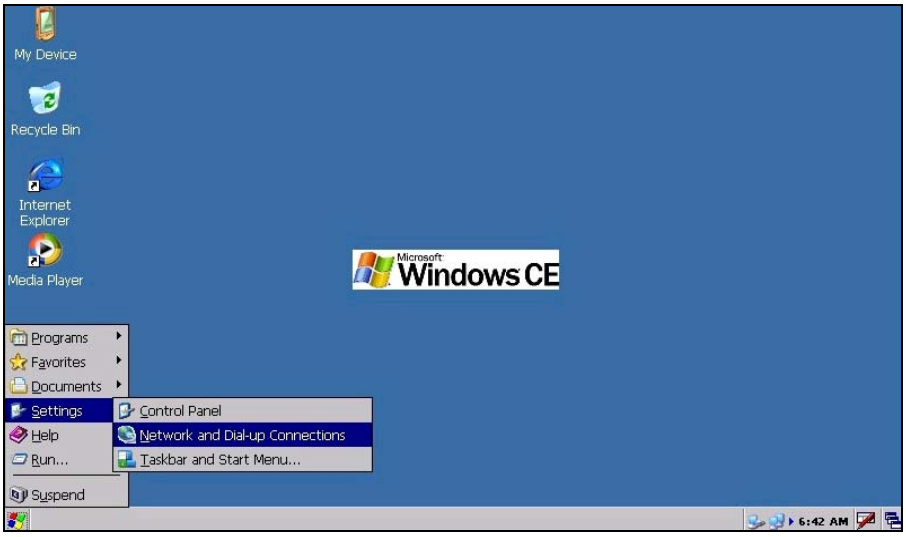


2.4 Internet setting

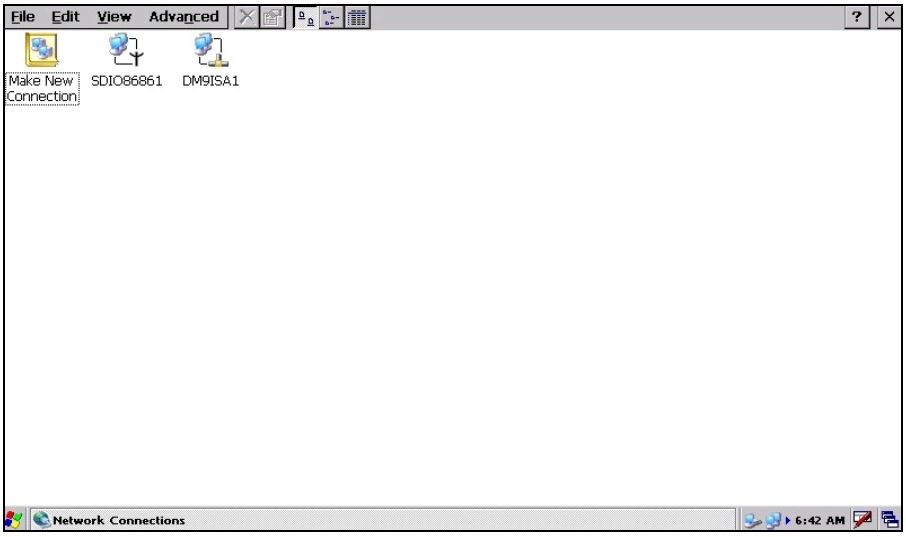
STEP1: Insert the internet line into the LAN port.



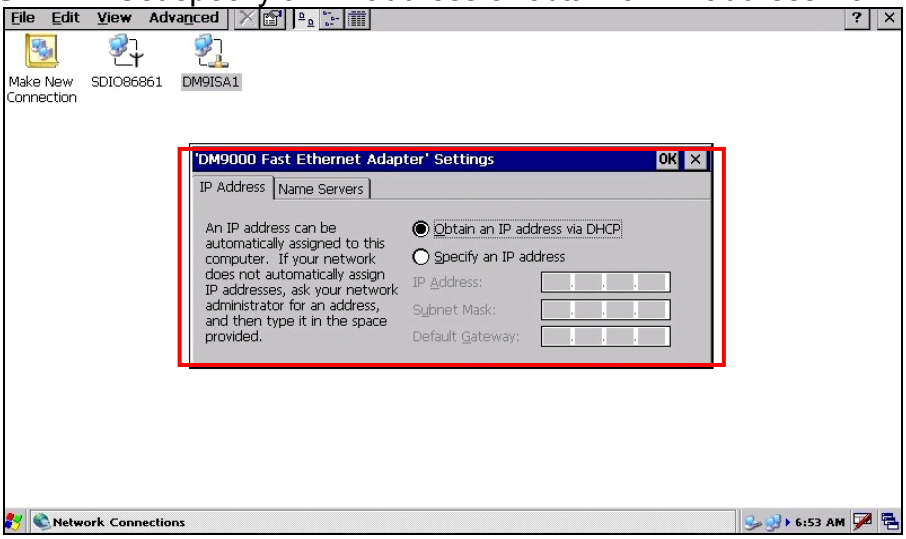
STEP2: Click Star → Setting → Network and Dail-up connections.



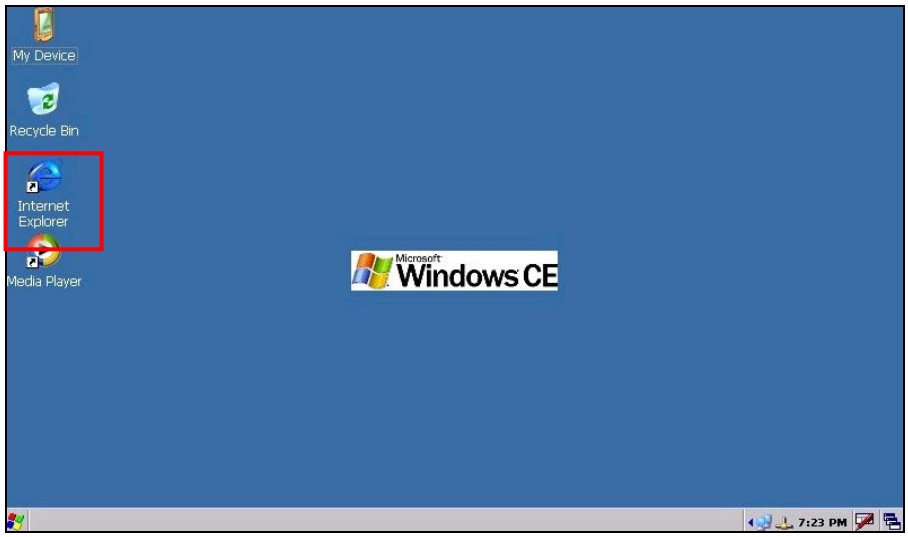
STEP3: Click DM9ISA1



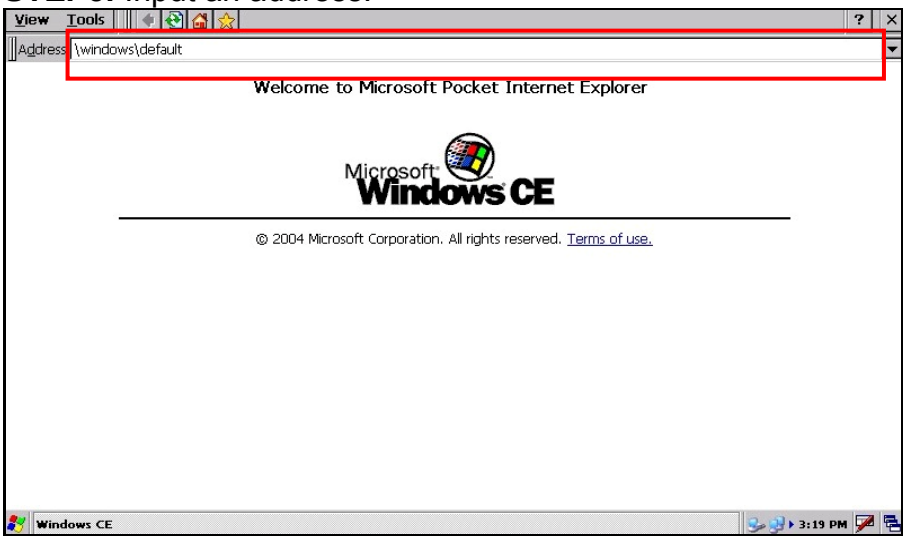
STEP4: Set specify an IP address or obtain an IP address via DHCP.


File Edit View Advanced
Make New Connection
SDIO86861
DM9ISA1
'DM9000 Fast Ethernet Adapter' Settings
OK
IP Address
Name Servers
An IP address can be automatically assigned to this computer. If your network does not automatically assign IP addresses, ask your network administrator for an address, and then type it in the space provided.
Obtain an IP address via DHCP
Specify an IP address
IP Address:
Subnet Mask:
Default Gateway:
Network Connections
6:53 AM

STEP5: Start to use internet.



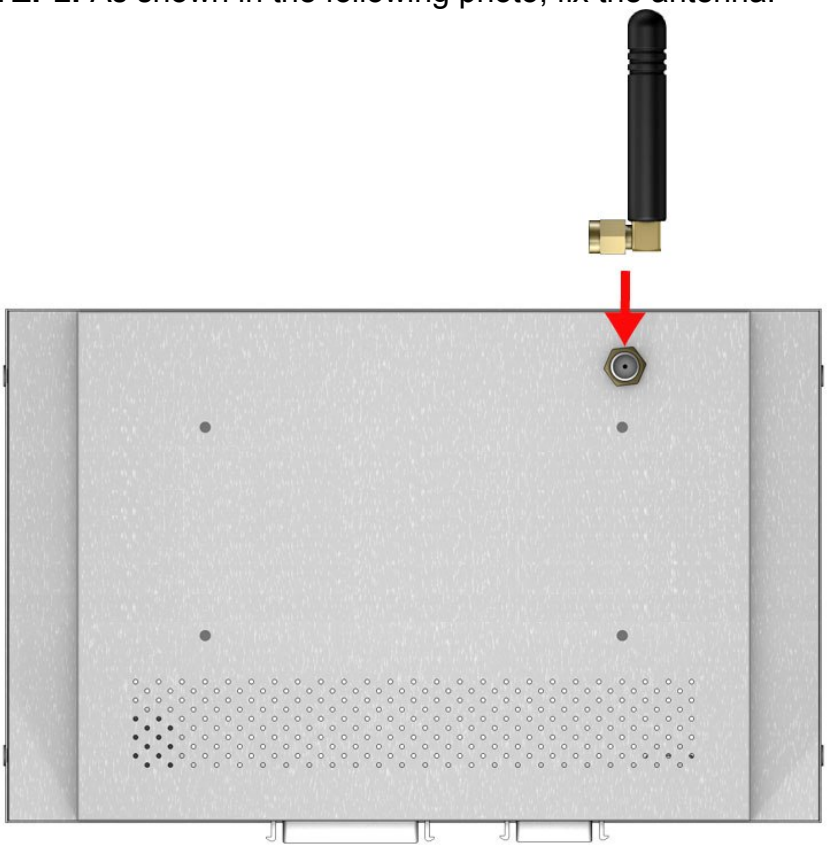
STEP6: Input an address.



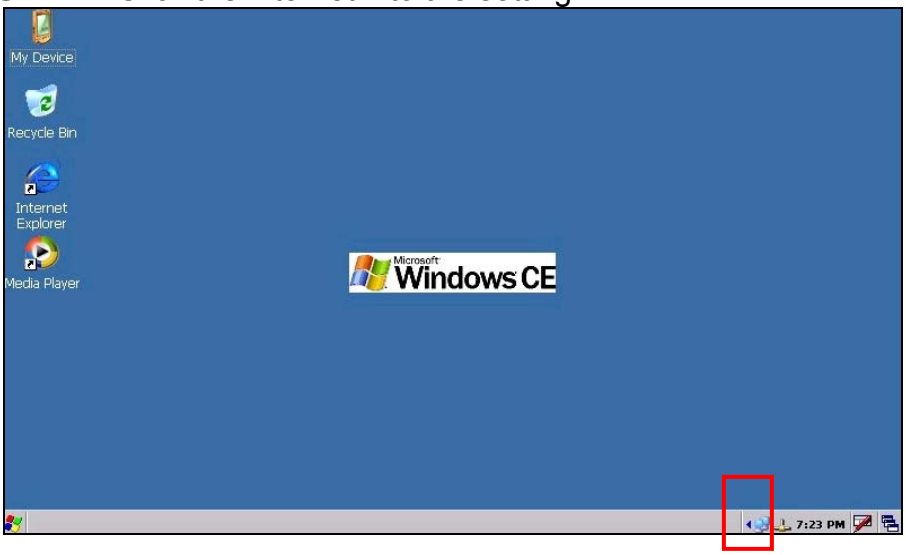
STEP7: Into the page.

2.5 Wi-Fi setting

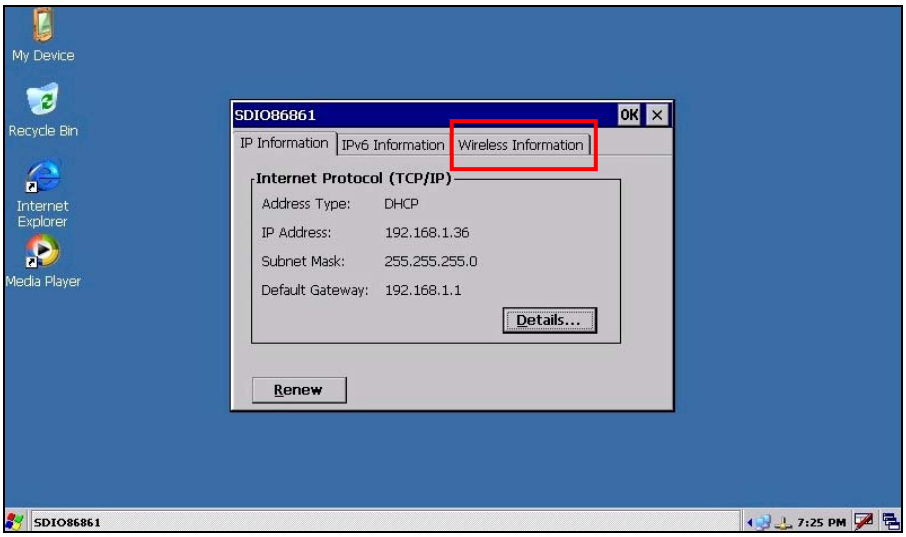
STEP1: As shown in the following photo, fix the antenna.



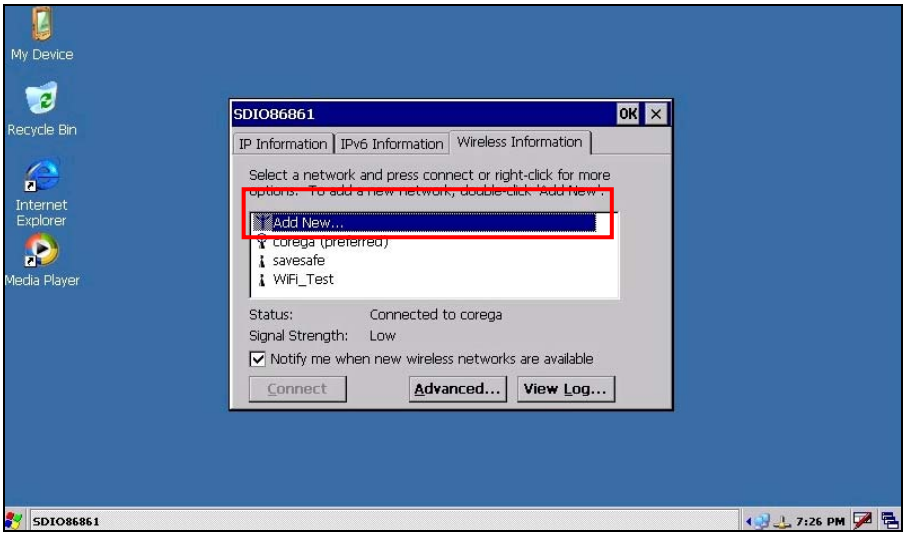
STEP2: Click the internet into the setting.



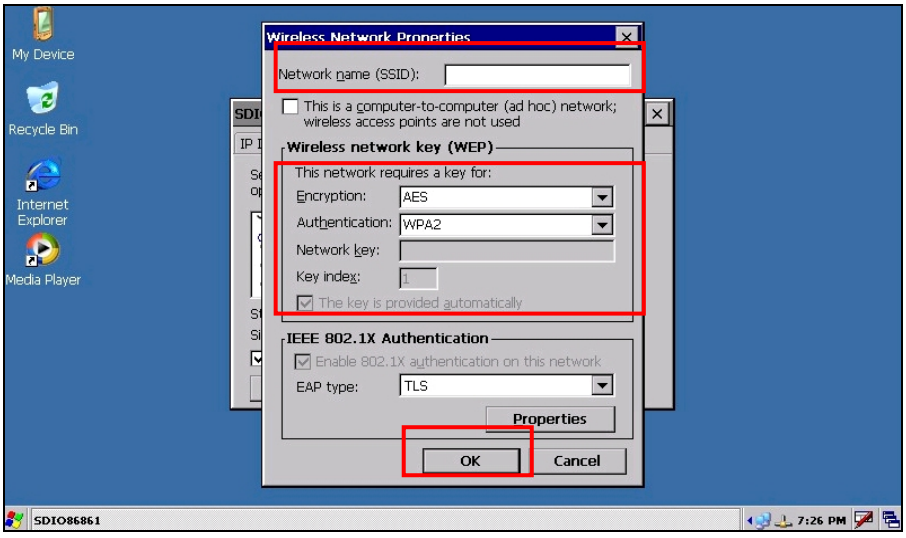
STEP3: Click Wireless Information.



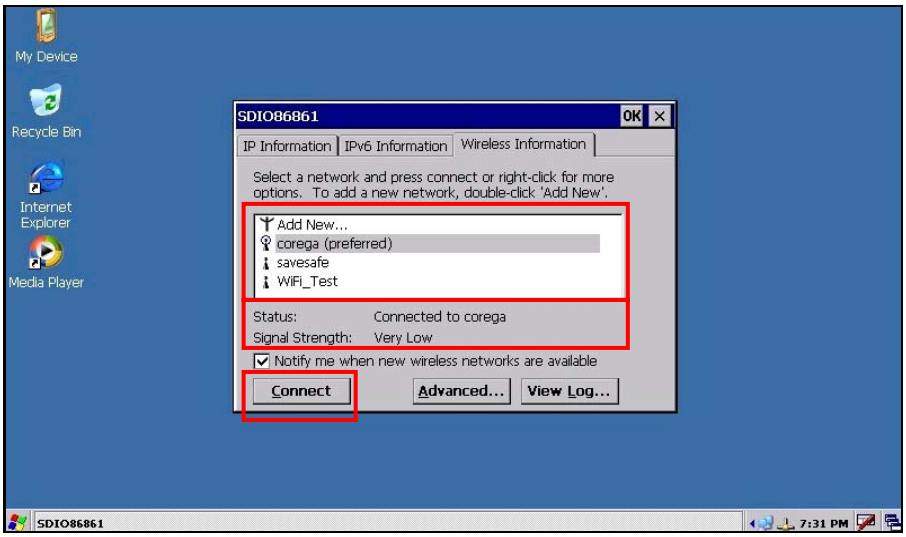
STEP4: Click Add New to add an internet.



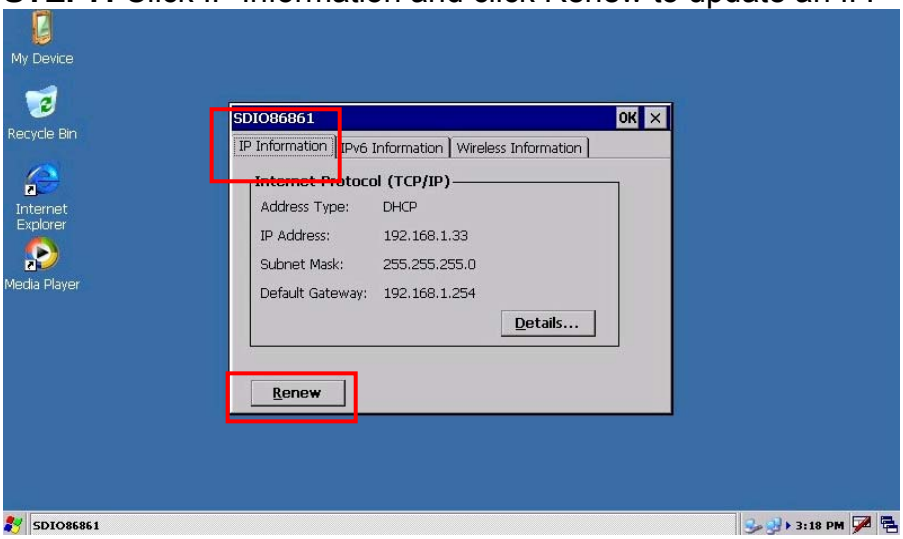
STEP5: Set the internet and click OK.



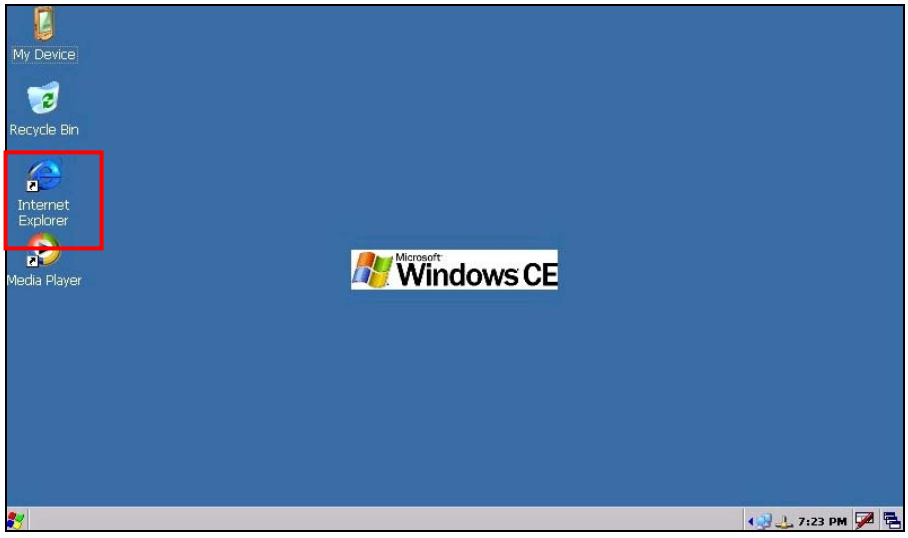
STEP6: Choose the internet and click connect.



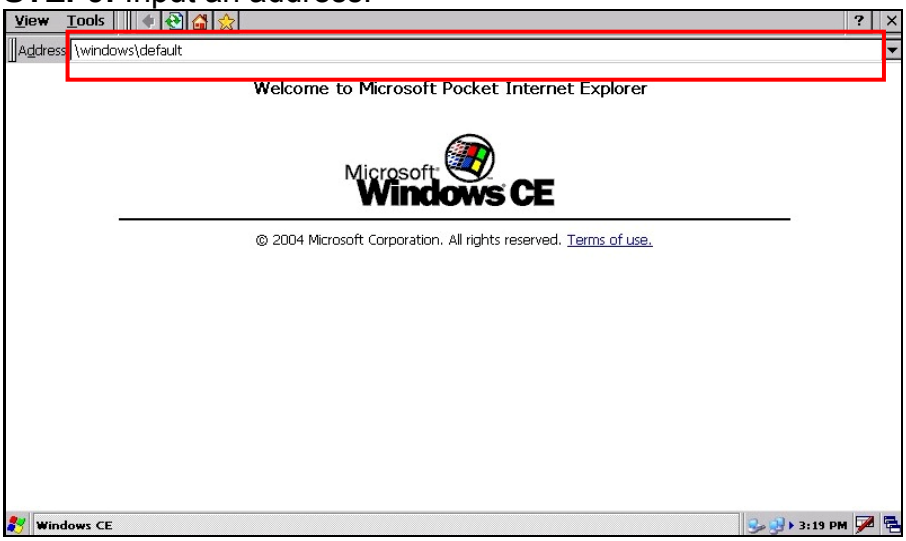
STEP7: Click IP Information and click Renew to update an IP.



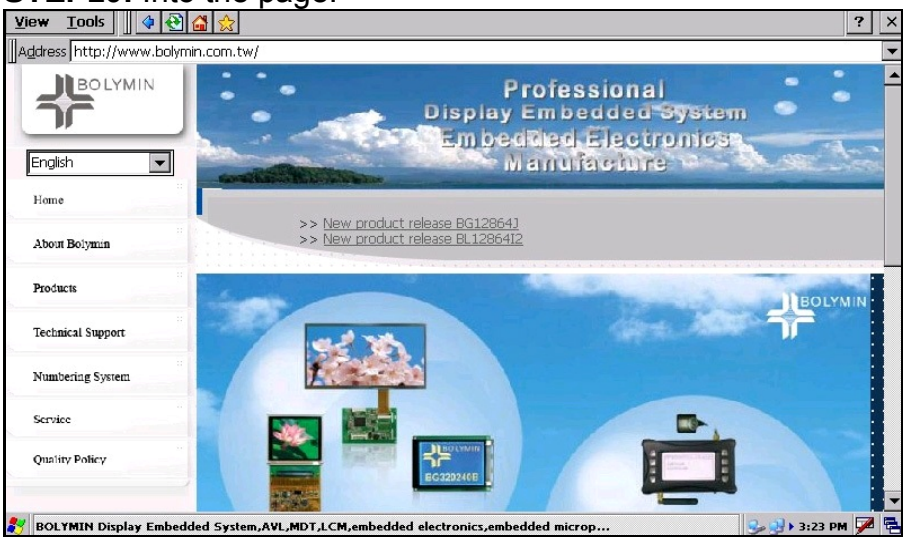
STEP8: Start to use internet.



STEP9: Input an address.

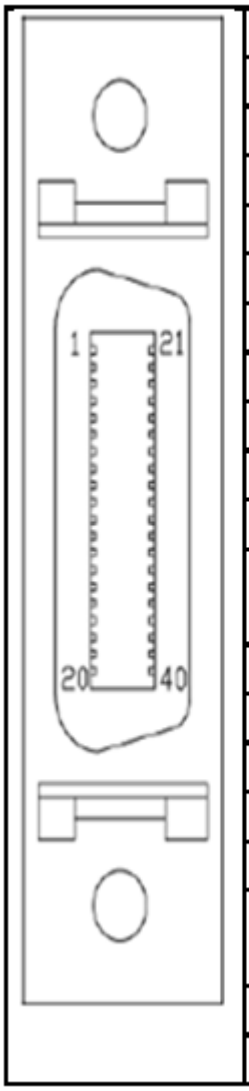


STEP10: Into the page.



2.6 Communication Bus

2.6.1 Communication Bus



1	VIN	Yellow/red	21	GND	Green/white
2	VIN	Yellow/blue	22	GND	Blue/white
3	DSPC1	Black	23	DSPC2	White/red
4	DSPC3	Brown	24	DSPC4	Brown/black
5	VIN	Brown/white	25	GND	Orange/green
6	USBDP	Red	26	USBDN	Red/black
7	VIN	Brown/green	27	GND	Orange/white
8	TXD1T	Orange	28	RXD1T	Orange/black
9	RTS1T	Yellow	29	CTS1T	Yellow/black
10	VBUS	Green	30	GND	Green/black
11	TXD2T	Blue	31	RXD2T	Blue/black
12	VBAT	X	32	GND	Red/white Red/green
13	TXD3T	Purple	33	RXD3T	Purple/black
14	VDD2	Grey	34	GND2	Orange/blue
15	A-422R+	White	35	A-422R-	White/black
16	A-485T+	Pink	36	A-485T-	Pink/black
17	VDD2	Grey/black	37	GND2	Red/blue
18	VBAT	X	38	GND	Purple/white Purple/red
19	nSS0T	Light green	39	SPIMOSI0T	Light green/black
20	SPIMISO0T	Light blue	40	SPICLK0T	Light blue/black

2.6.2 Serial Port Test

BEGA220A supports three sets of RS232 and one set of RS485 (option) or one set of RS422 (option).

2.6.2.1 Connect Serial Port to PC

1st set of RS232 (Debug Port)(only for update)- Connect 1st set of RS232 to DB9 female connector as shown on below chart, and connect to COM port of PC. This port is defaulted to a debug port and not for external use. Its signal level is at ±12 volt.

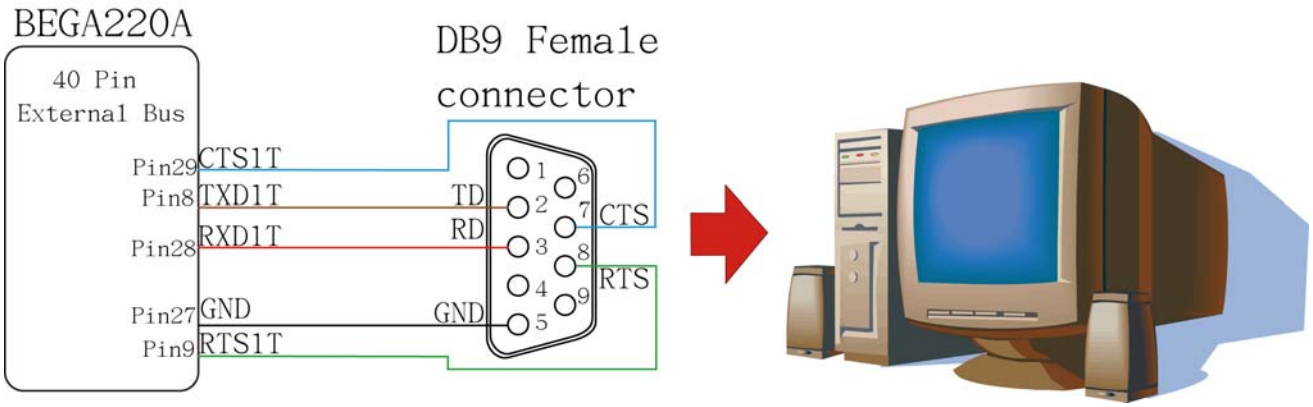


Table of 1st RS232 Pin Assignment			
RS232 DB9 Female		**BEGA220A**	
Pin No	**Pin Name**	**Pin No**	**Pin Name**
1	**DCD**	**—**	**—**
2	**TD**	**8**	**TXD1T**
3	**RD**	**28**	**RXD1T**
4	**DTR**	**—**	**—**
5	**GND**	**27**	**GND**
6	**DSR**	**—**	**—**
7	**CTS**	**29**	**CTS1T**
8	**RTS**	**9**	**RTS1T**
9	**RI**	**—**	**—**

2nd set of RS232 (COM3)- Connect 2nd set of RS232 to DB9 female connector as shown on below chart, and connect to COM port of PC. This port is defaulted to COM3 with a signal level is at ±12 volt.

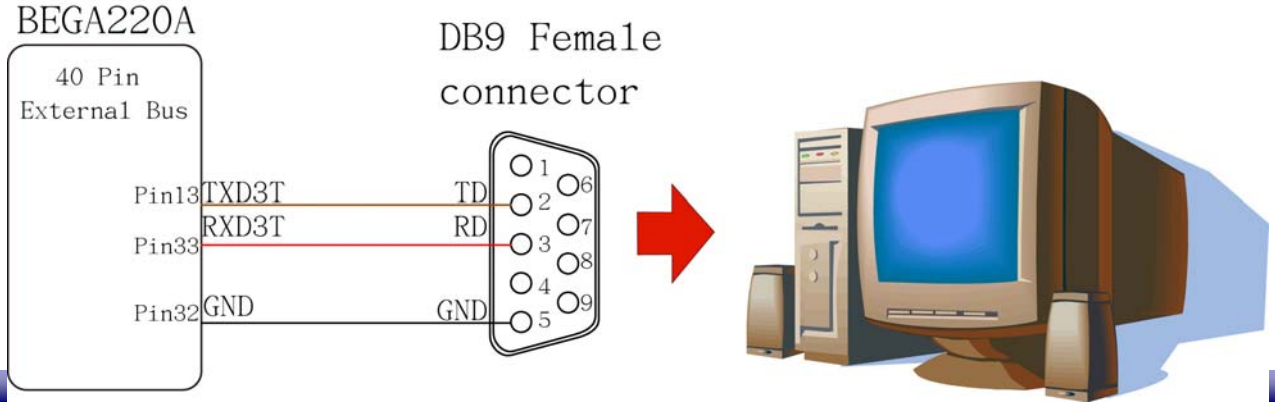


Table of 2nd RS232 Pin Assignment			
RS232 DB9 Female		BEGA220A	
Pin No	Pin Name	Pin No	Pin Name
1	DCD	—	—
2	TD	13	TXD3T
3	RD	33	RXD3T
4	DTR	—	—
5	GND	32	GND
6	DSR	—	—
7	CTS	—	—
8	RTS	—	—
9	RI	—	—

3rd set of RS232(COM4) - Connect 3rd set of RS232 to DB9 female connector as shown on below chart, and connect to COM port of PC. This port is defaulted to COM4 with a signal level is at ±12 volt.

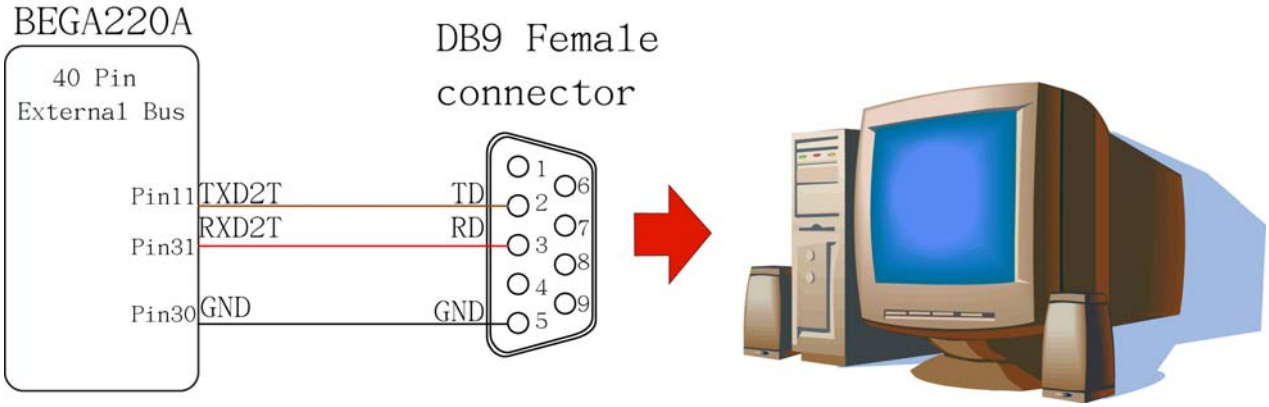


Table of 3rd RS232 Pin Assignment			
RS232 DB9 Female		BEGA220A	
Pin No	Pin Name	Pin No	Pin Name
1	DCD	—	—
2	TD	11	TXD2T
3	RD	31	RXD2T
4	DTR	—	—
5	GND	30	GND
6	DSR	—	—
7	CTS	—	—
8	RTS	—	—
9	RI	—	—

RS422 (Option)(COM1)- Use software to set COM 1. Signal level is at ±12 volt. Connect with a device for testing or use a transfer board of RS232 to connect with PC for testing.

Table of RS422 Pin assignment	
Pin No	**Pin Name**
35	**A-422R-**
15	**A-422R+**
16	**A-485T+**
36	**A-485T-**
34	**GND2**

***RS422 and RS485 cannot operate in the same time.**
***Connect PIN14 to PIN12 and PIN12 to PIN 34 if do not need isolate.**
Connect PIN14 and PIN34 to another power of 4.75~5.25V if need isolate.

RS485 (Option)(COM1) - Use software to set COM 1. Signal level is at ±12 volt. Connect with a device for testing or use a transfer board of RS232 to connect with PC for testing.

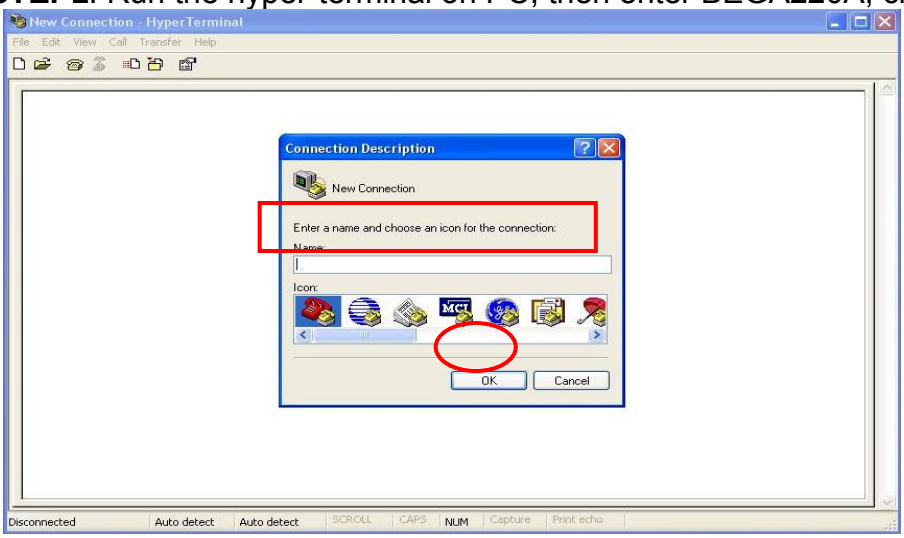
Table of RS485 Pin assignment	
Pin No	**Pin Name**
37	**GND2**
16	**A-485T+**
36	**A-485T-**

***RS422 and RS485 cannot operate in the same time.**
***Connect PIN14 to PIN12 and PIN12 to PIN 34 if do not need isolate.**
Connect PIN14 and PIN34 to another power of 4.75~5.25V if need isolate.

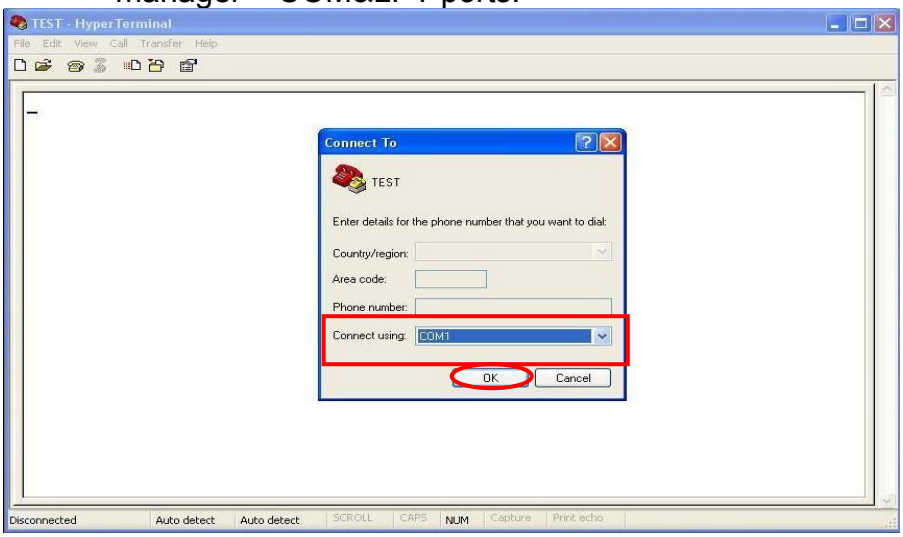
2.6.2.2 Serial Port test

Upon completion of serial connection of BEGA220A to PC, users may use hyper-terminal to diagnose the communication link. Here is the step guide to install hyper-terminal at PC end.

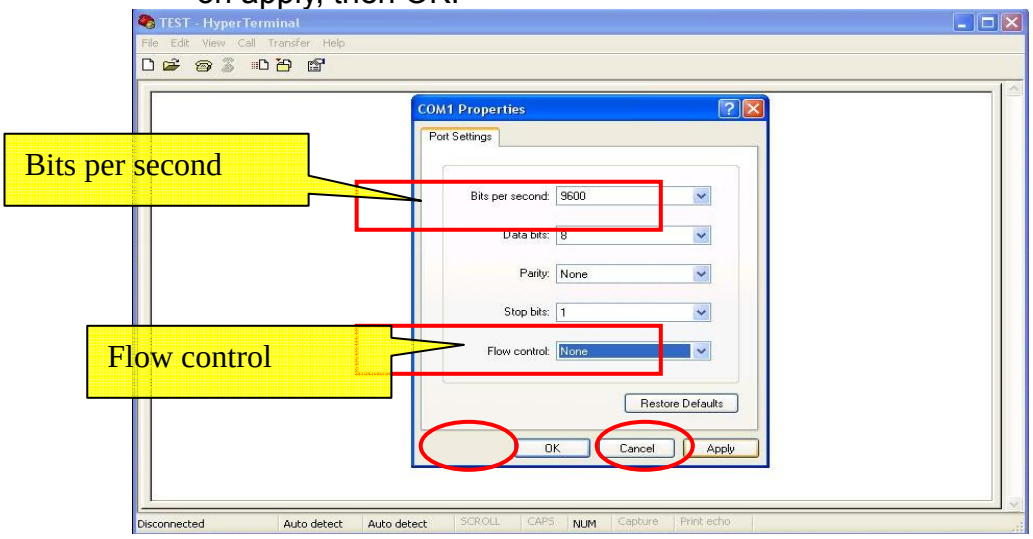
STEP1: Run the hyper-terminal on PC, then enter BEGA220A, click on OK.



STEP2: A “”Connect to” pops up, “Connect using”, select the applicable COM port, click OK. To find applicable COM port, click Control panel – system – hardware – device manager – COM&LPT ports.

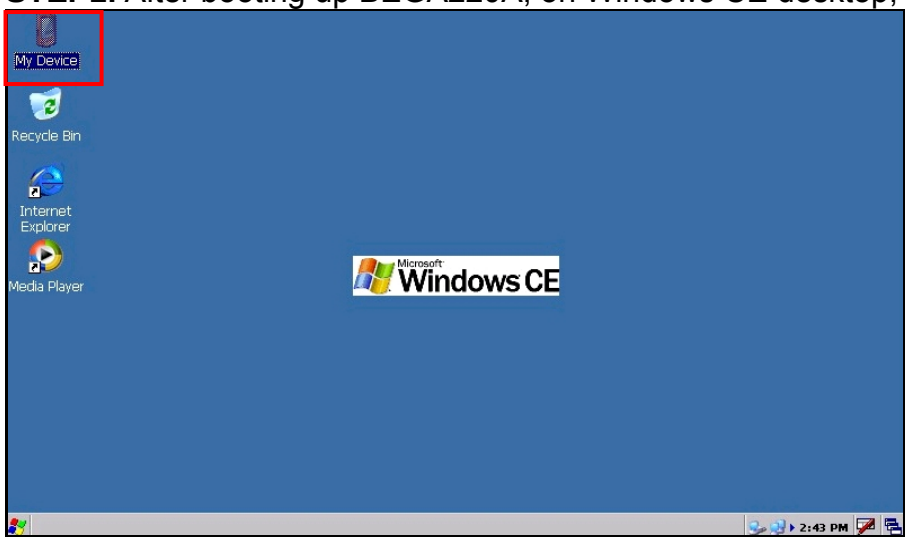


STEP3: A “COMx Properties” pops up, make sure the “bits per second” (or baud rate) and ”flow control” settings match with those on BEGA220A. A typical baud rate of BEGA220A ranges from 9600 to 115200 and use “None” for flow control. Click on apply, then OK.

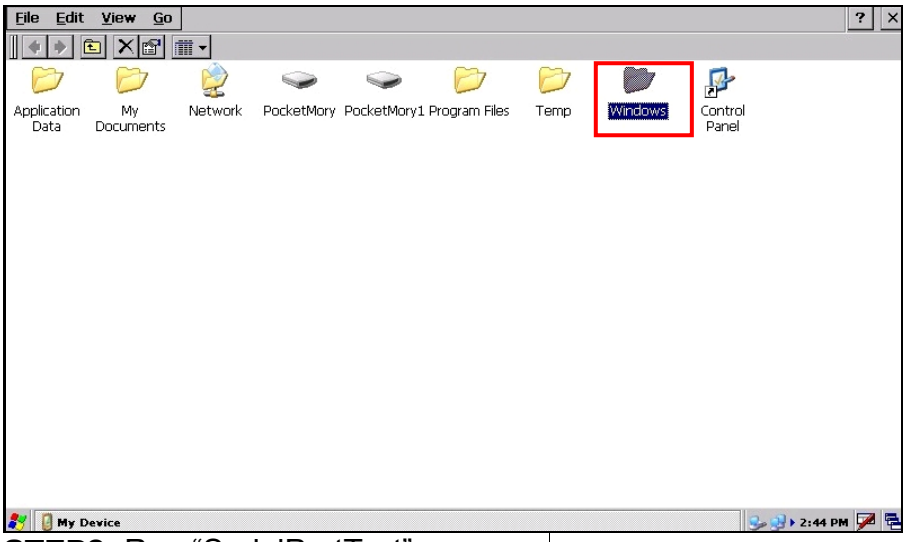


BETA903A set up:

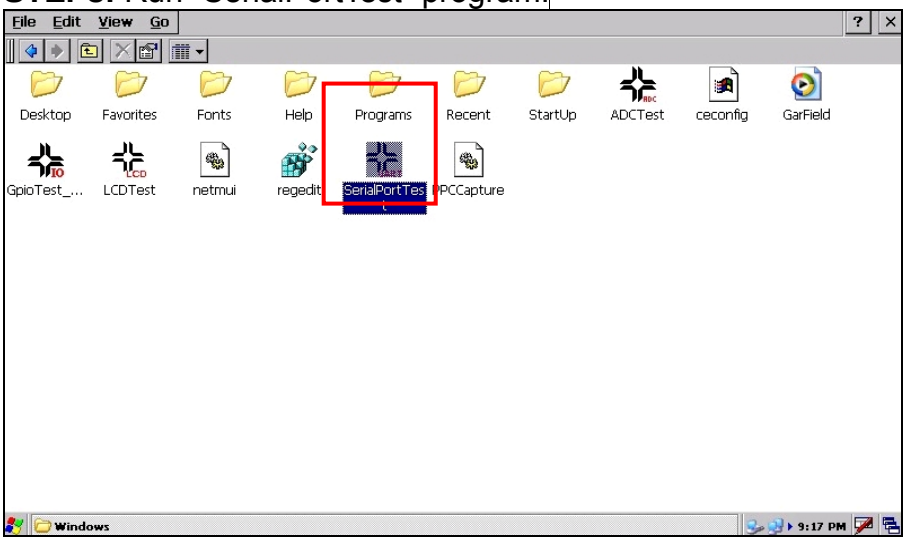
STEP1: After booting up BEGA220A, on Windows CE desktop, click on “My Device”.



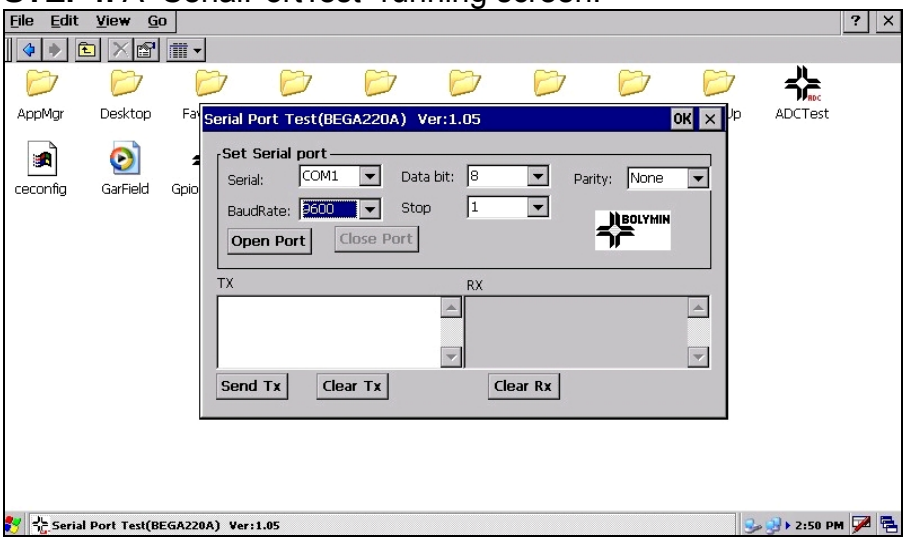
STEP2: Select “Windows” folder.



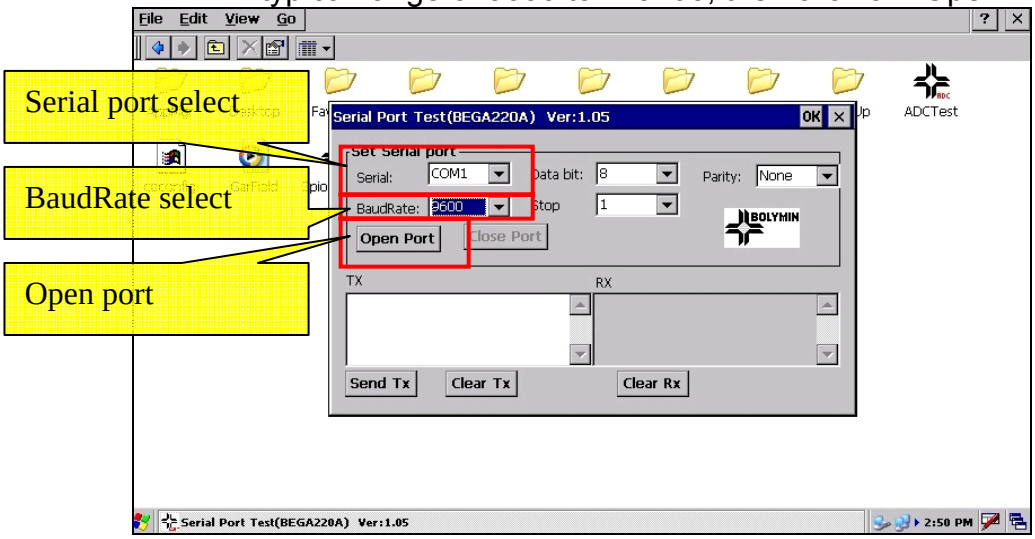
STEP3: Run “SerialPortTest” program.



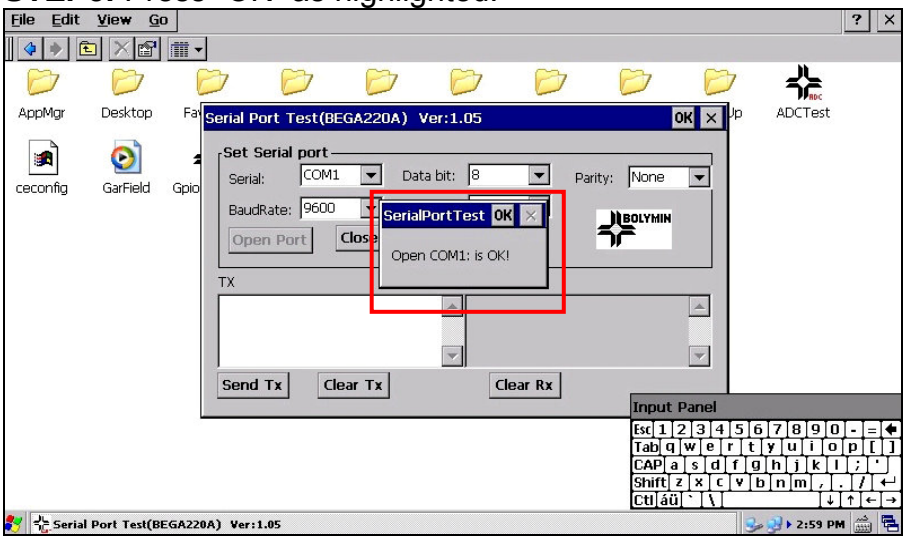
STEP4: A “SerialPortTest” running screen.



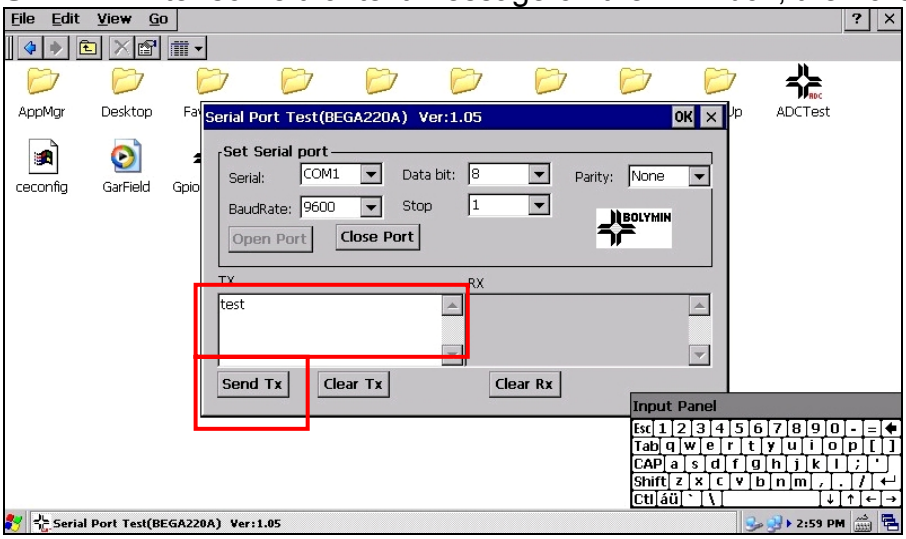
STEP5: Please make sure the baud rate setting on PC and BEGA220A are identical with a typical range of 9600 to 115200, then click on “Open Port” to connect to PC.



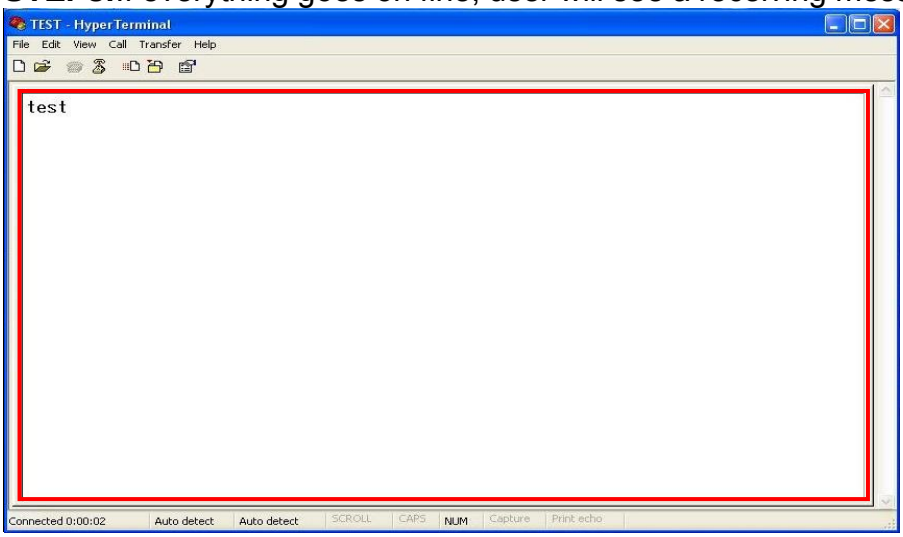
STEP6: Press “OK” as highlighted.



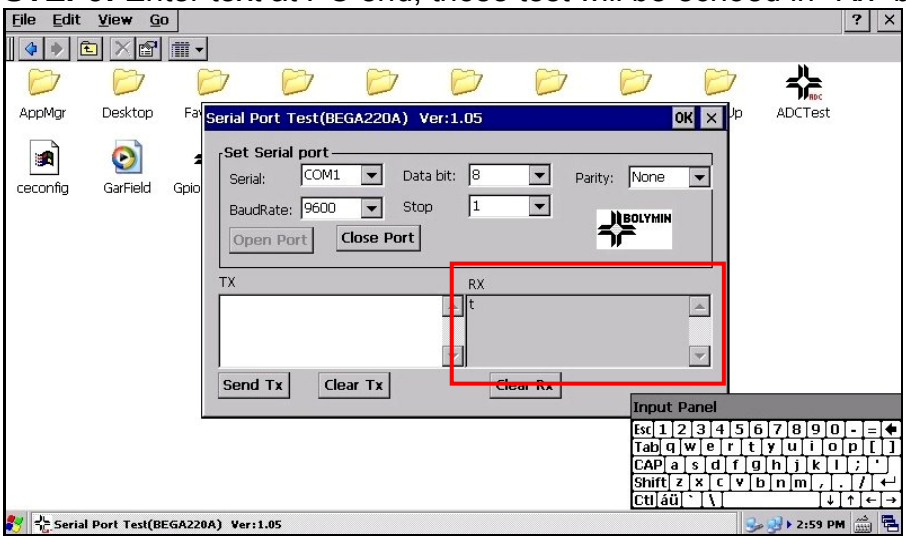
STEP7: Enter some trial text message on the “TX” box, then click on “Send Tx”.



STEP8: If everything goes on fine, user will see a receiving message as the one transmitted.



STEP9: Enter text at PC end, those test will be echoed in “Rx” box at BEGA220A.



2.6.3 Device USB setting up

BEGA220A provides one of Device USB to connect with PC and use software of ActiveSync. As shown on below chart, and connect to USB.

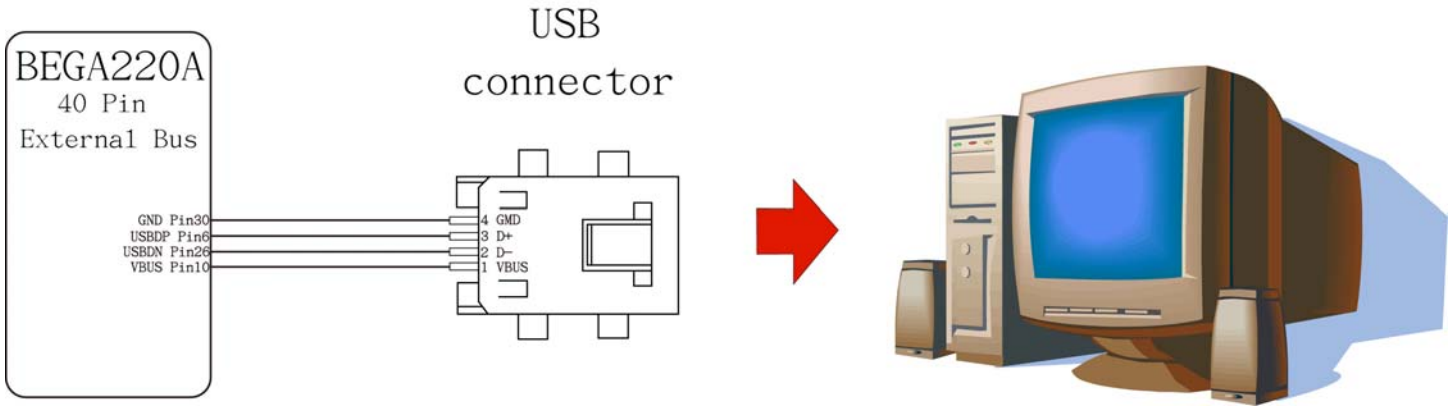
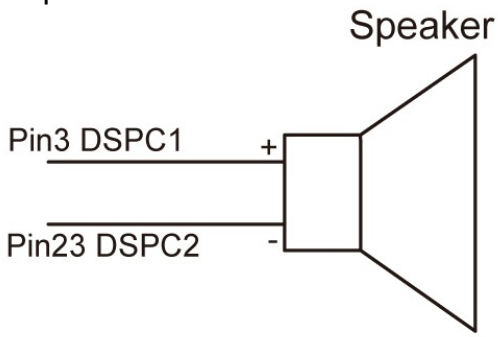
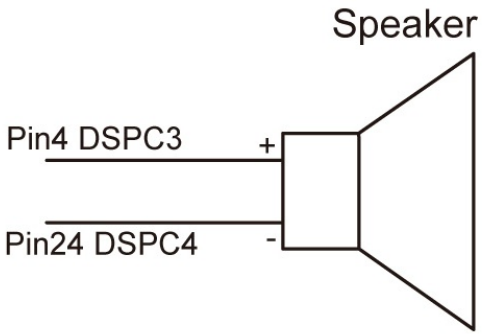


Table of Device USB Pin assignment			
USB		BEGA220A	
Pin No	Pin Name	Pin No	Pin Name
1	VBUS	10	VBUS
2	D-	26	USBDN
3	D+	6	USBDP
4	GND	30	GND

2.6.4 Speaker setting up

BEGA220A provides two sets of Speaker of 8Ω/2W. As shown on below chart, and connect to Speaker.





1st set Speaker

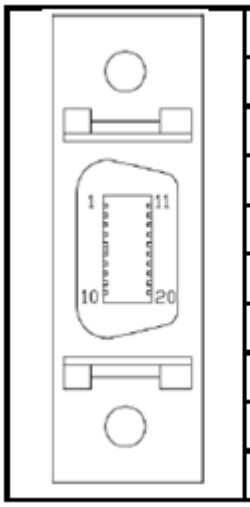
Table of 1st set Speaker Pin assignment			
Speaker		BEGA220A	
Pin No	Pin Name	Pin No	Pin Name
1	+	3	DSPC1
2	-	23	DSPC2

2nd set Speaker

Table of 2nd set Speaker Pin assignment			
Speaker		BEGA220A	
Pin No	Pin Name	Pin No	Pin Name
1	+	4	DSPC3
2	-	24	DSPC4

2.7 ADC_GPIO Bus

2.7.1 Table of ADC_GPIO Bus Pin assignment



1	ADCT0	Brown	11	ADCT3	Blue
2	ADCT1	Orange	12	ADCT4	Blue/black
3	ADCT2	Brown/black	13	ADCT5	Purple
4	GND	Orange/black	14	GND	White
5	KEY 1	Red	15	KEY 6	Purple/black
6	KEY 2	Yellow	16	KEY 7	White/black
7	KEY 3	Red/black	17	KEY 8	Grey
8	KEY 4	Yellow/black	18	KEY 9	Light blue
9	KEY 5	Green	19	KEY 10	Grey/black
10	KEY 11	Green/black	20	KEY 12	Light blue/black

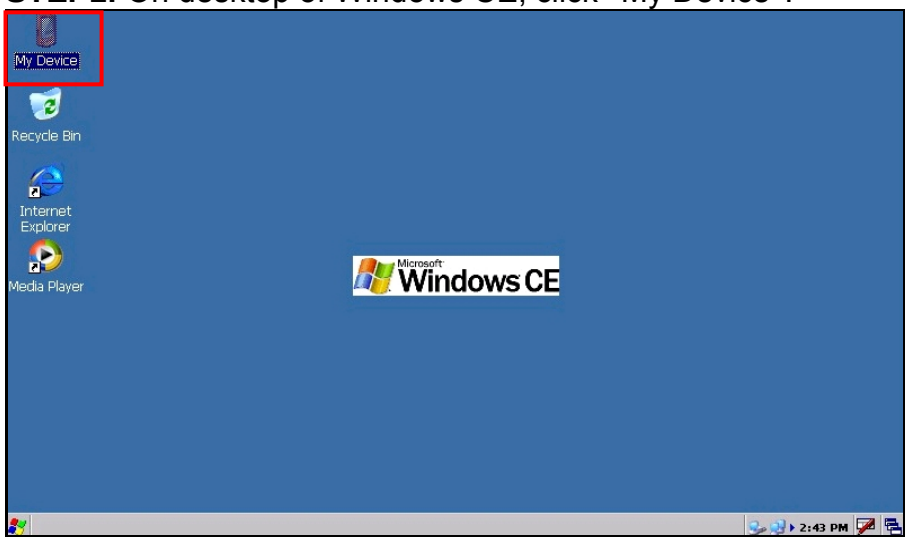
2.7.2 GPIO test

BEGA220A provides a build-in GPIO test program. Simply follows the recommended GPIO circuit as illustrated on Chapter 4.4, then start using this test program to validate the GPIO ports.

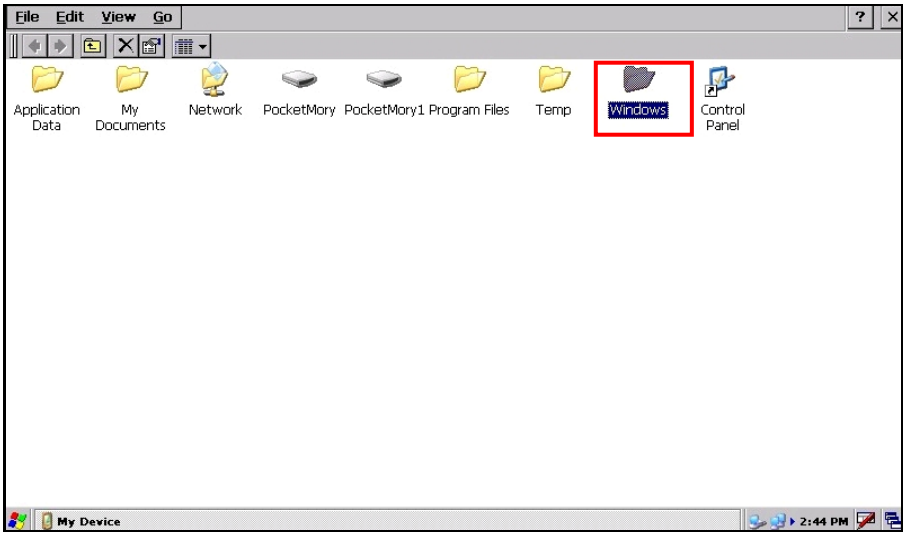
Item	Symbol	Min	Typ	Max	Unit
High Level Input Voltage	VIH	2.3	—	3.6	V
Low Level Input Voltage	VIL	-0.3	—	09	V
High Level Output Voltage	VOH	3.1	—	3.3	V
Low Level Output Voltage	VOL	—	—	0.2	V

Test Procedure:

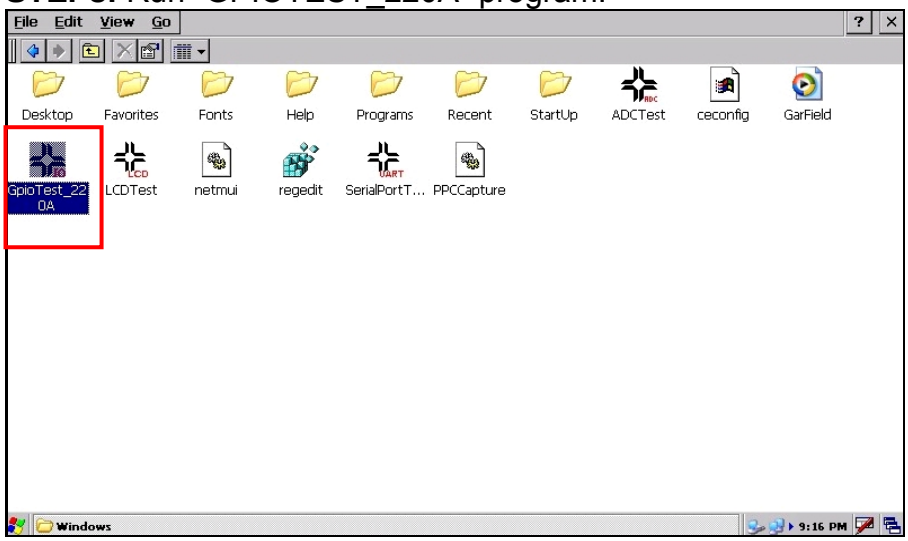
STEP1: On desktop of Windows CE, click “My Device”.



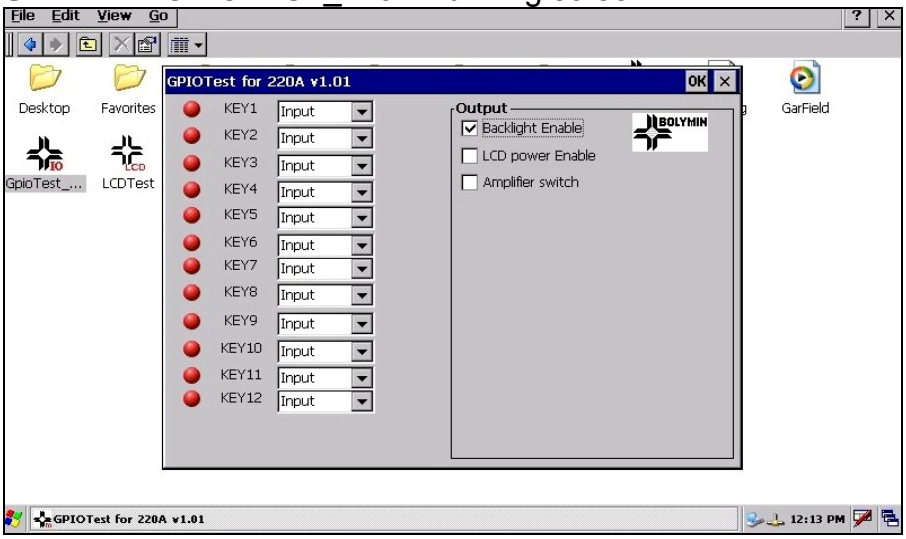
STEP2: Select “windows” folder.



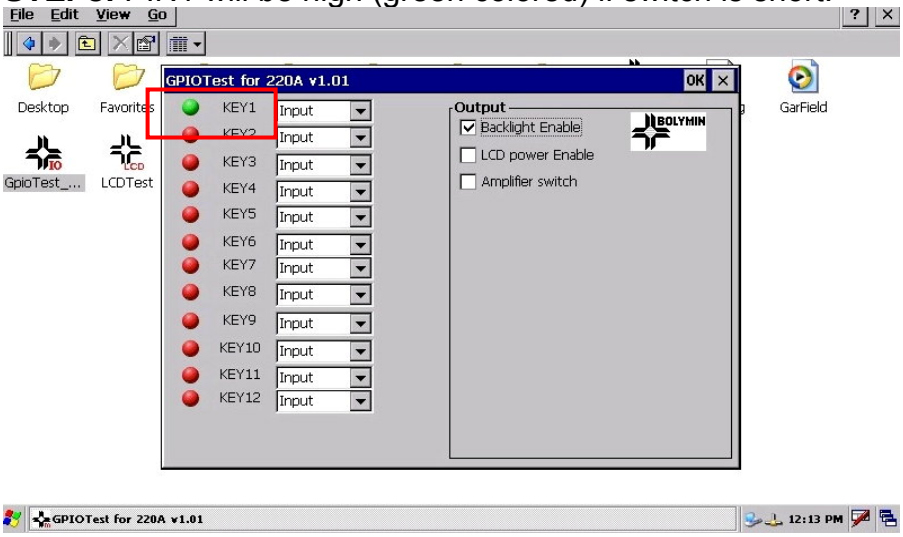
STEP3: Run “GPIOTEST_220A” program.



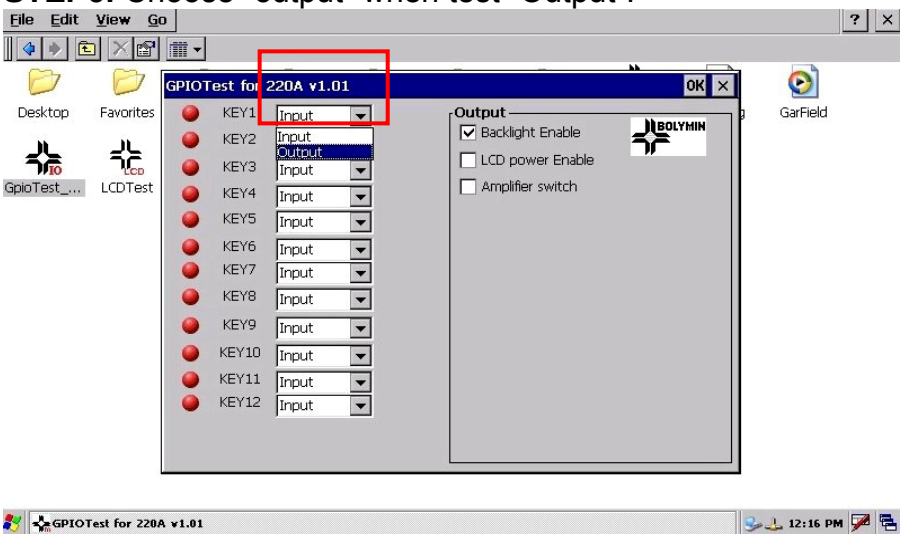
STEP4: A “GPIOTEST_220A” running screen.



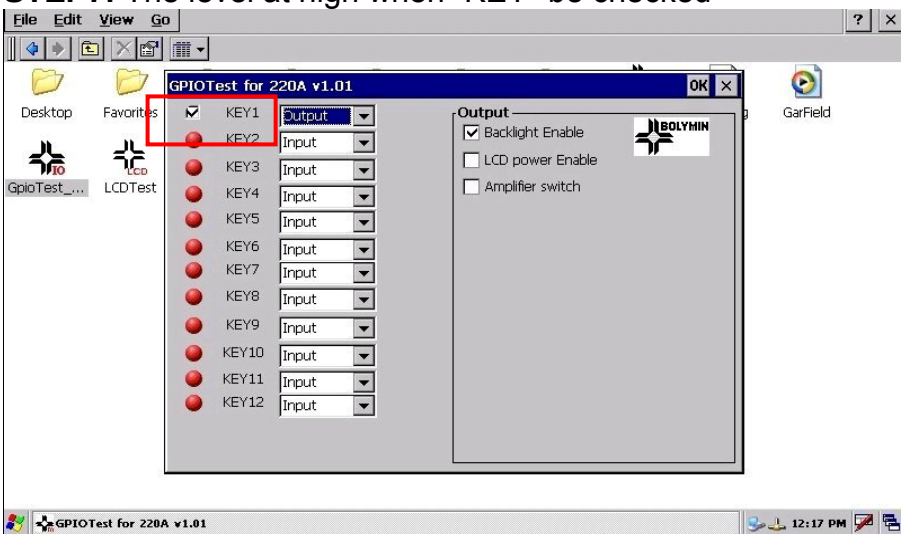
STEP5: PIN1 will be high (green colored) if switch is short.



STEP6: Choose “output” when test “Output”.



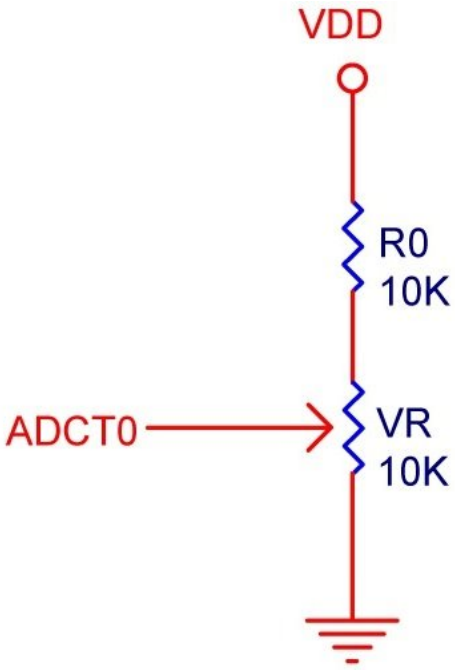
STEP7: The level at high when “KEY” be checked



2.7.3 ADC test

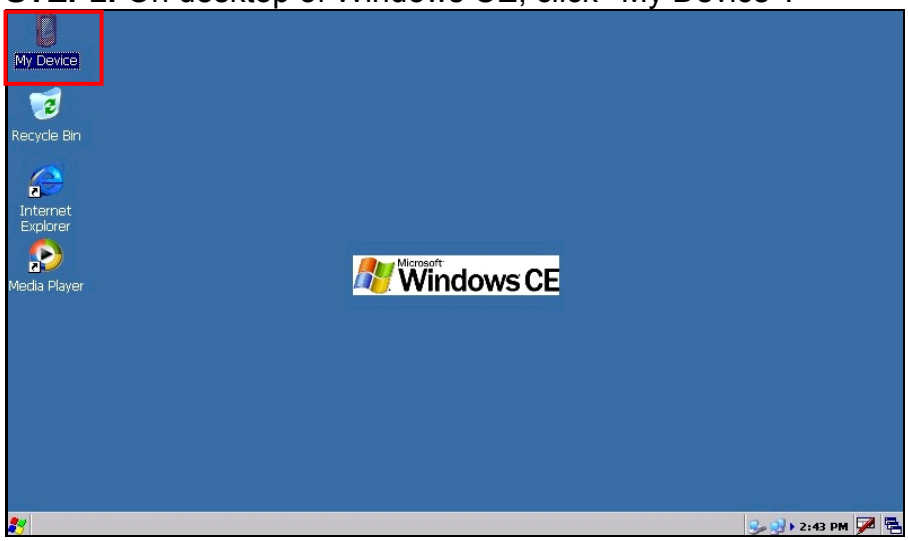
2.7.3.1 ADC connection of testing

As shown on below chart, connect ADC test circuit and use internal power of BEGA220A. The max. voltage is 1.6V.

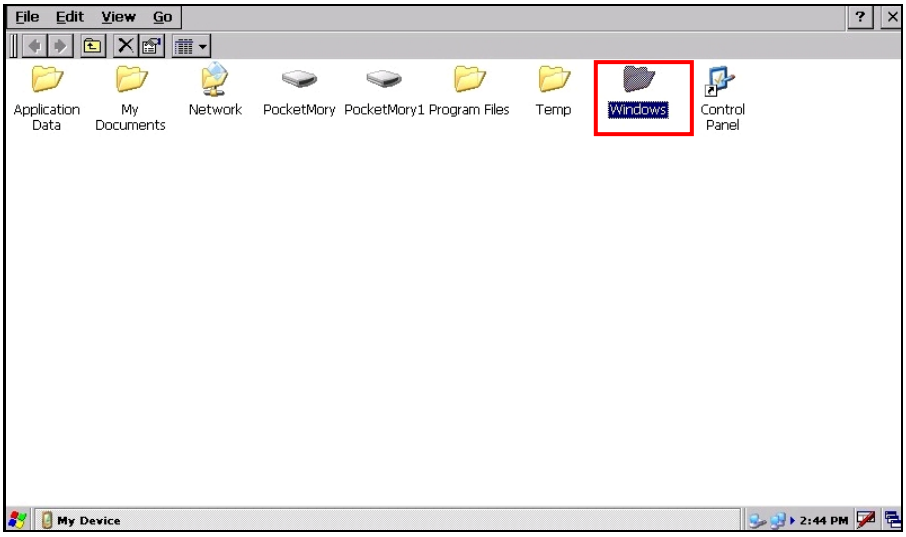


2.7.3.2 ADC test

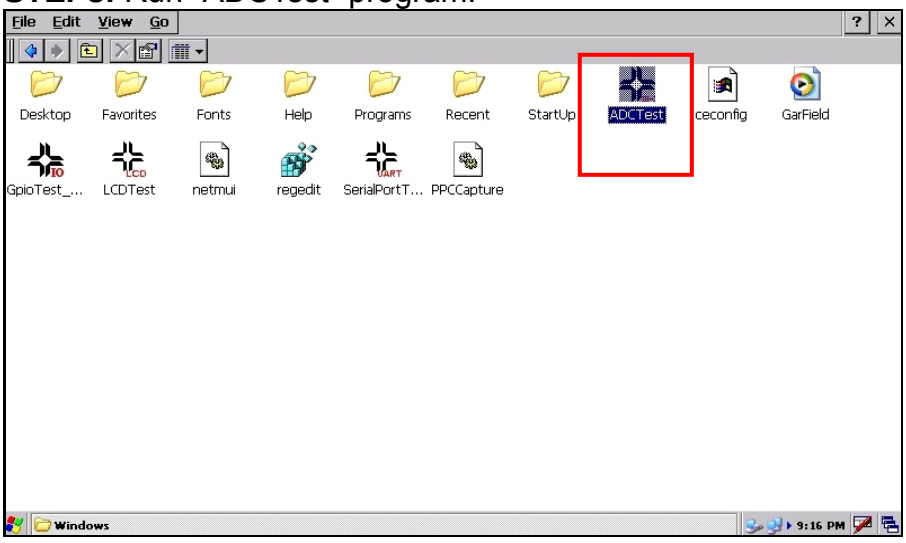
STEP1: On desktop of Windows CE, click “My Device”.



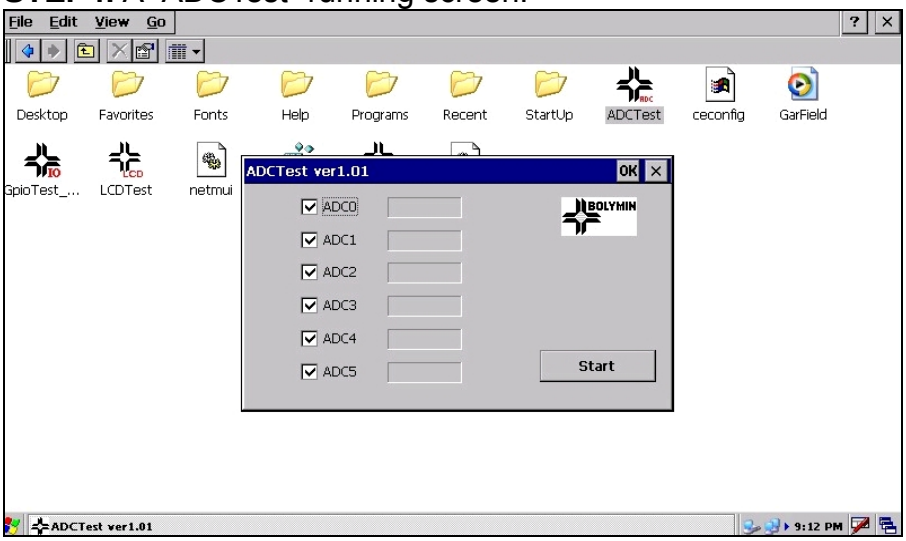
STEP2: Select “windows” folder.



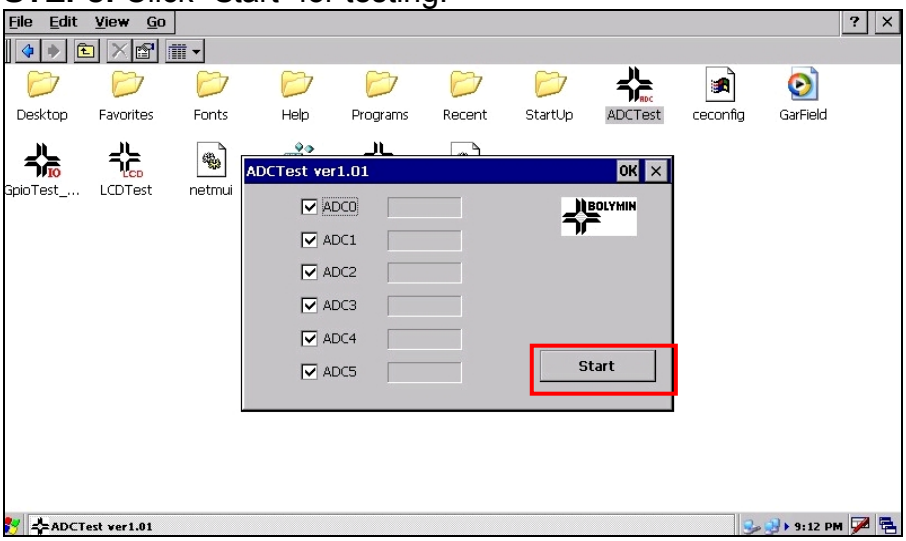
STEP3: Run ”ADCTest” program.



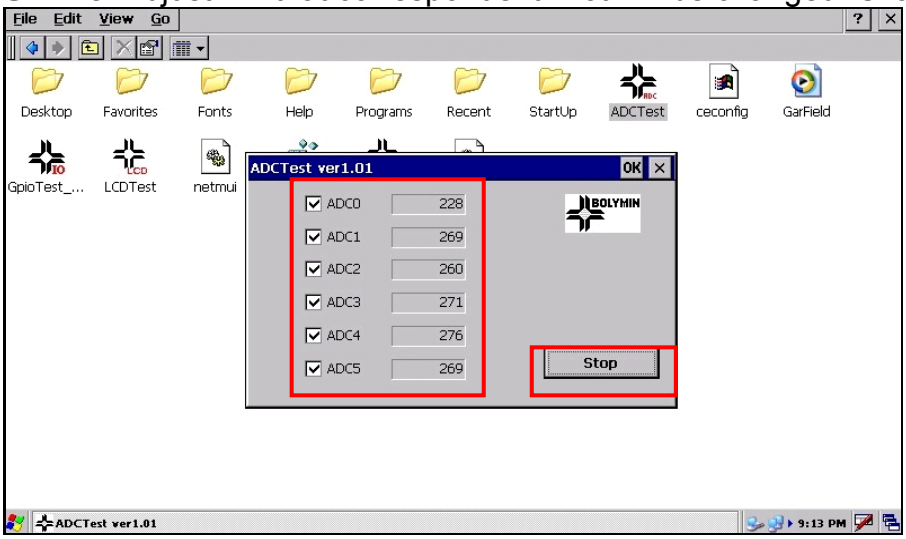
STEP4: A “ADCTest” running screen.



STEP5: Click “Start” for testing.



STEP6: Adjust VR that correspondent Prot will be changed. Click “Stop” to stop the test.



Chapter 3 BEGA220A Programming Guide

摘要

這章節提供 **BEGA220A** 如何和 **PC** 連線，和如何使用軟體控制 **Serial Port**，**GPIO**，**ADC**，**Backlight**，**SPI**。

包含部份:

3.1 Transfer File Between BEGA220A and PC
3.2 Programming for BEGA220A
3.3 Serial Port Function
3.4 GPIO Control
3.5 A/D Converter and Backlight Adjustment

3.1 Transfer File Between BEGA220A and PC

3.1.1 Connect PC and BEGA220A

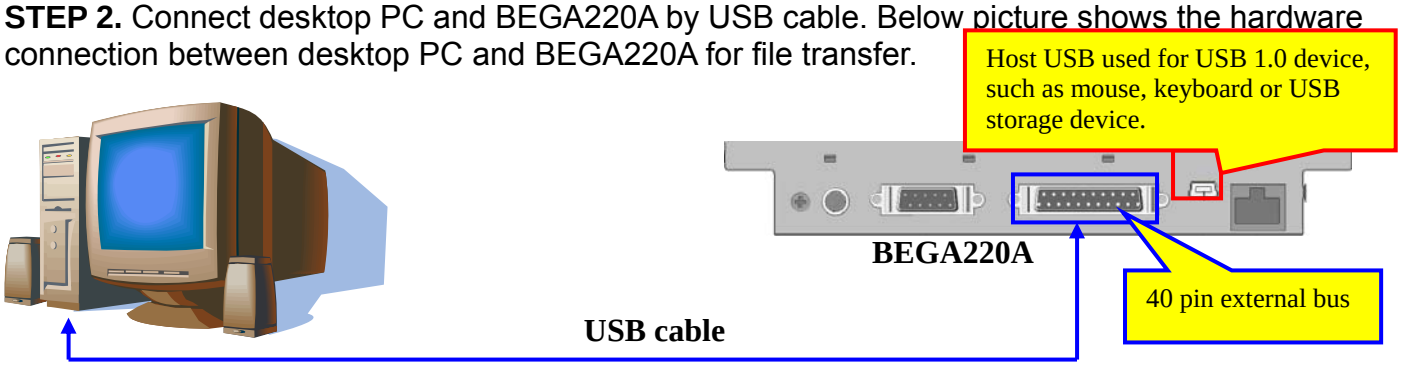
User could setup the connection between desktop PC and BEGA220A by following steps:

STEP 1. Install Microsoft ActiveSync 4.5 on desktop PC. The installation file of ActiveSync could be downloaded at

http://www.microsoft.com/downloads/details.aspx?familyid=9e641c34-6f7f-404d-a04b-dc09f8141141&displaylang=en&tm

After installation, you need to restart PC.

STEP 2. Connect desktop PC and BEGA220A by USB cable. Below picture shows the hardware connection between desktop PC and BEGA220A for file transfer.



Please note that **the USB cable should plug into the connector of device USB wiring from the 40 pin external bus**. Below table shows the pin assignment of device USB on the 40 pin external bus.

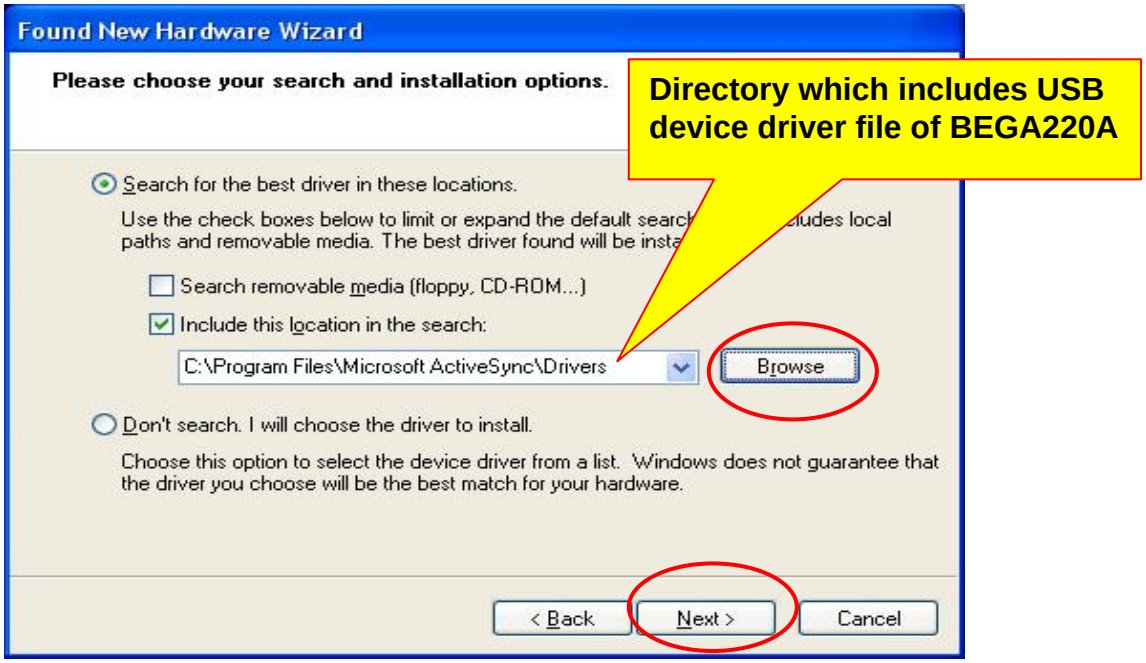
USB connector		40 pin external bus of BEGA220A	
Pin No	**Pin Name**	**Pin No**	**Pin Name**
1	VBUS	10	VBUS
2	D-	26	USBDN
3	D+	6	USBDP
4	GND	30	GND

STEP 3. Power on BEGA220A and connect BEGA220A and PC by USB cable. For the first connection, windows system on PC will request the USB device driver of BEGA220A. Please install USB driver by following procedures.

(1). Select the advance item on below dialog and click “Next” button.

Found New Hardware Wizard
This wizard helps you install software for:
SEC S3C2443X Test B/D
If your hardware came with an installation CD or floppy disk, insert it now.
What do you want the wizard to do?
Install the software automatically (Recommended)
Install from a list or specific location (Advanced)
Click Next to continue.
< Back
Next >
Cancel

(2). Click “Browse” button and then select the directory which includes USB device driver file of BEGA220A. Click “Next” button.


Found New Hardware Wizard
Please choose your search and installation options.
Directory which includes USB device driver file of BEGA220A
Search for the best driver in these locations.
Use the check boxes below to limit or expand the default search
paths and removable media. The best driver found will be insta
Search removable media (floppy, CD-ROM...)
Include this location in the search:
C:\Program Files\Microsoft ActiveSync\Drivers
Browse
Don't search. I will choose the driver to install.
Choose this option to select the device driver from a list. Windows does not guarantee that the driver you choose will be the best match for your hardware.
< Back
Next >
Cancel

(3). Click “Continue” button

Hardware Installation
The software you are installing for this hardware:
Samsung SYSLSI USB Sync
has not passed Windows Logo testing to verify its compatibility with Windows XP. (Tell me why this testing is important.)
Continuing your installation of this software may impair or destabilize the correct operation of your system either immediately or in the future. Microsoft strongly recommends that you stop this installation now and contact the hardware vendor for software that has passed Windows Logo testing.
Continue Anyway
STOP Installation

(4). Click “Finish” button. Now BEGA220A could connect to PC by ActiveSync.

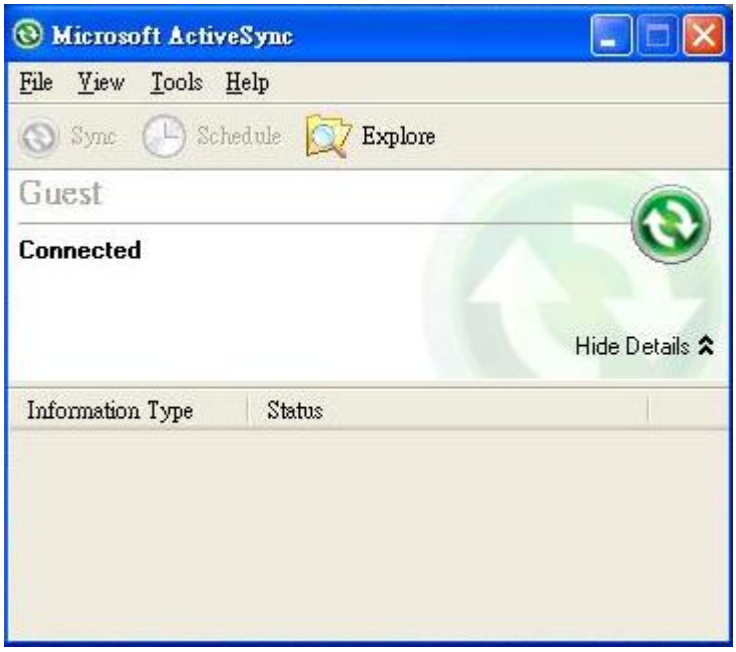
Found New Hardware Wizard
Completing the Found New Hardware Wizard
The wizard has finished installing the software for:
Samsung SYSLSI USB Sync
Click Finish to close the wizard.
< Back
Finish
Cancel

(5). Select “No” and click “Next” button to cancel the synchronization.

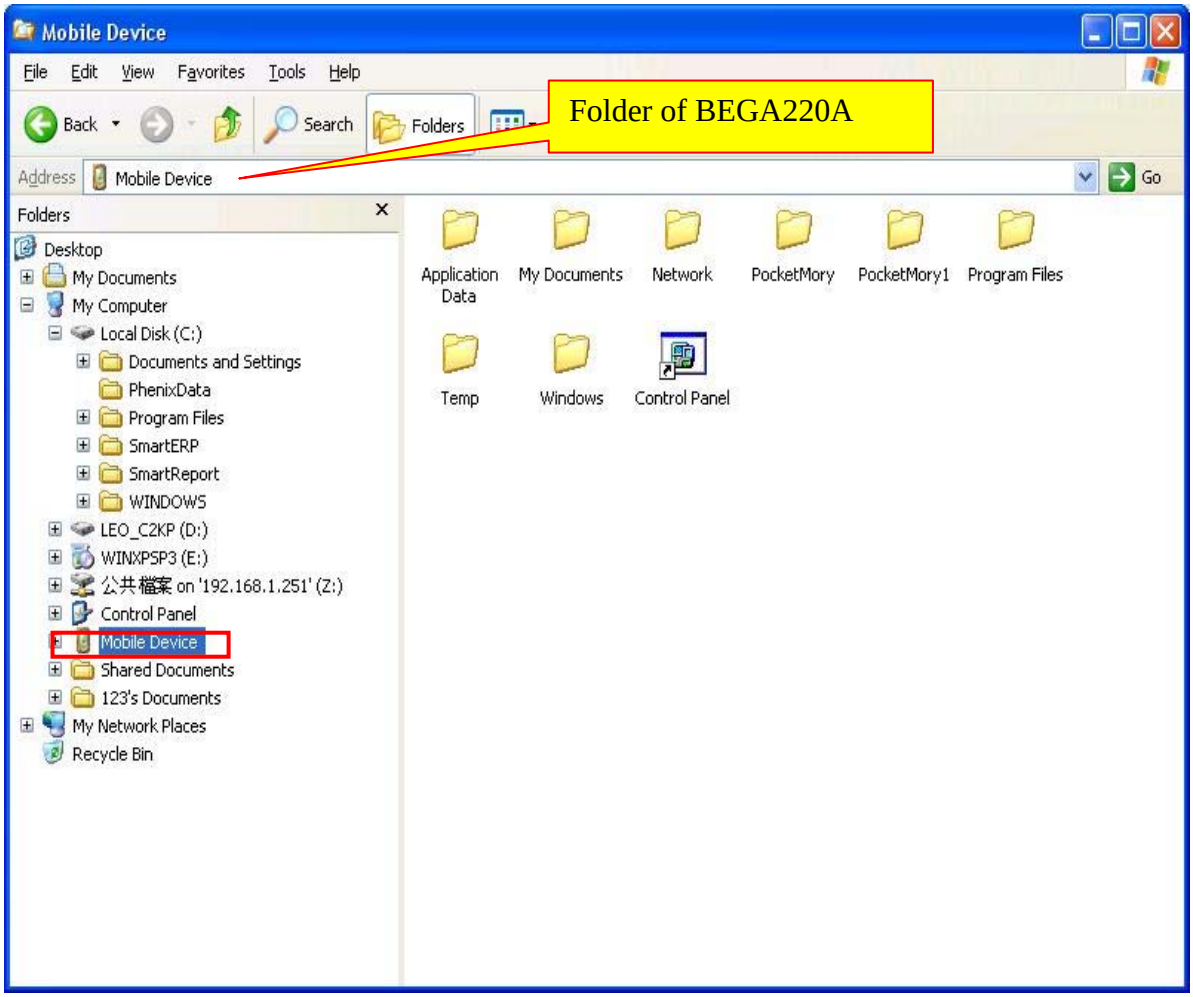
New Partnership
Set Up a Partnership
Before you can synchronize information between your mobile device and this computer, you must set up a partnership between them.
Would you like to set up a partnership?
Yes
Set up a partnership so that I can synchronize information between my device and this computer.
No
I don't want to synchronize information. Set up my device as a guest so that I can copy or move information between my device and this computer.
< Back
Next >
Cancel
Help

3.1.2 Transfer Files

After connecting PC and BEGA220A, below screen will display. The green cycle means the connection between PC and BEGA220A has been built.



Execute ”Explore” program and move into the folder of BEGA220A, you can transfer files between PC and BEGA220A



3.2 Programming for BEGA220A

3.2.1 Setup Development environment

By following steps, we can setup the development environment for WinCE 5.0:

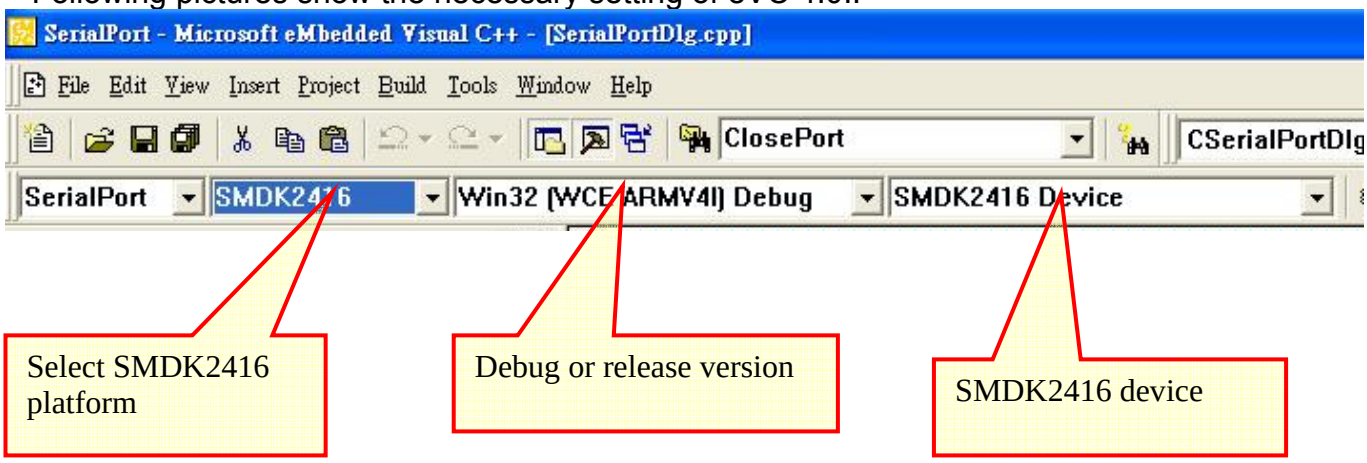
1. **Install Microsoft eMbedded Visuall C++ 4.0(eVC 4.0) into desktop PC :** eVC 4.0 can be downloaded from http://www.microsoft.com/downloads/details.aspx?FamilyID=1DACDB3D-50D1-41B2-A107-FA75AE960856&displayLang=en.

2. **Connect BEGA220A and Desktop PC by procedures in section 3.1.2**

3. **Install SDK of BEGA220A provided by Bolymin.** The installation file could be found in the product CD.

4. **The platform setting of embedded Visual C++:**

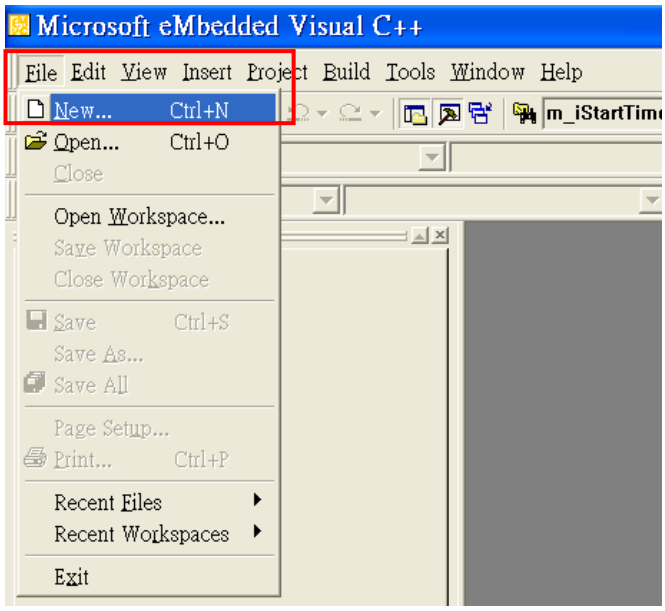
Following pictures show the necessary setting of eVC 4.0::



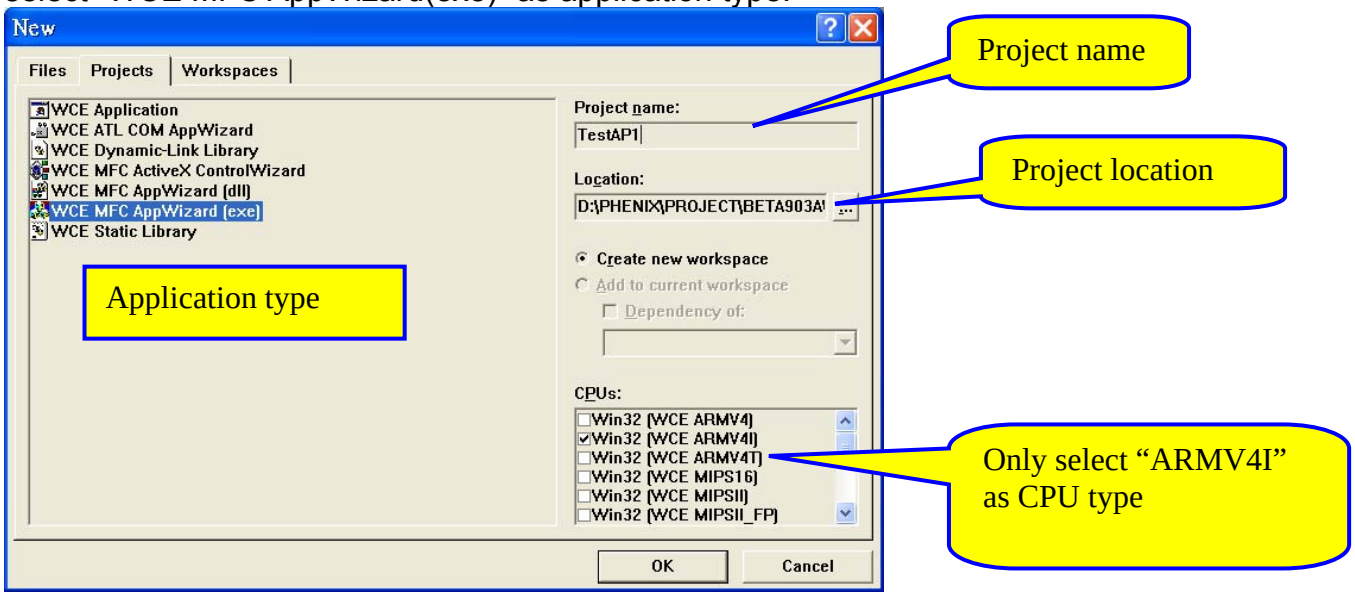
3.2.2 Create New Project

In this section, we will describe how to create a new project in eVC 4.0. An experienced programmer could jump to next section directly.
You could create a new project for your application by following steps:
STEP 1: Execute eVC 4.0.

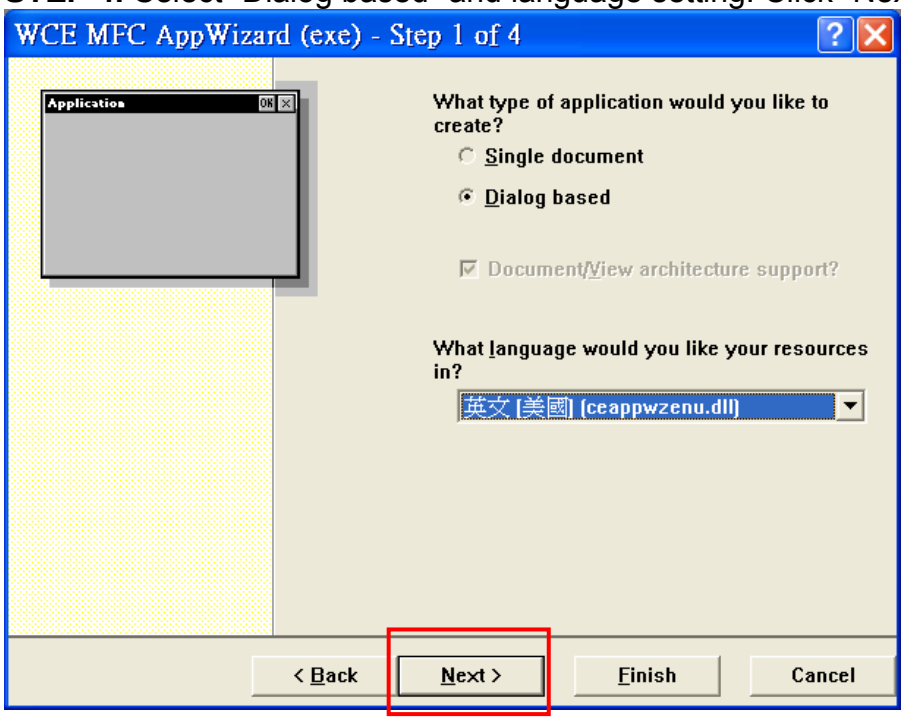
STEP 2: Select “File”-“New…: function



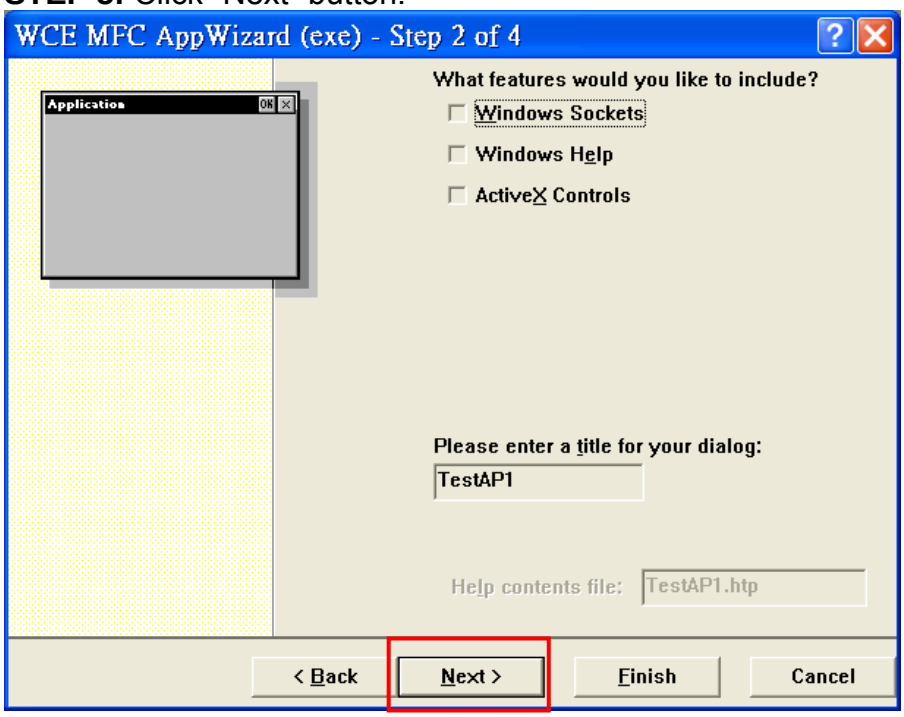
STEP 3: Select your application type, setup the location and name of your project and. Please select “WCE MFC AppWizard(exe)” as application type.



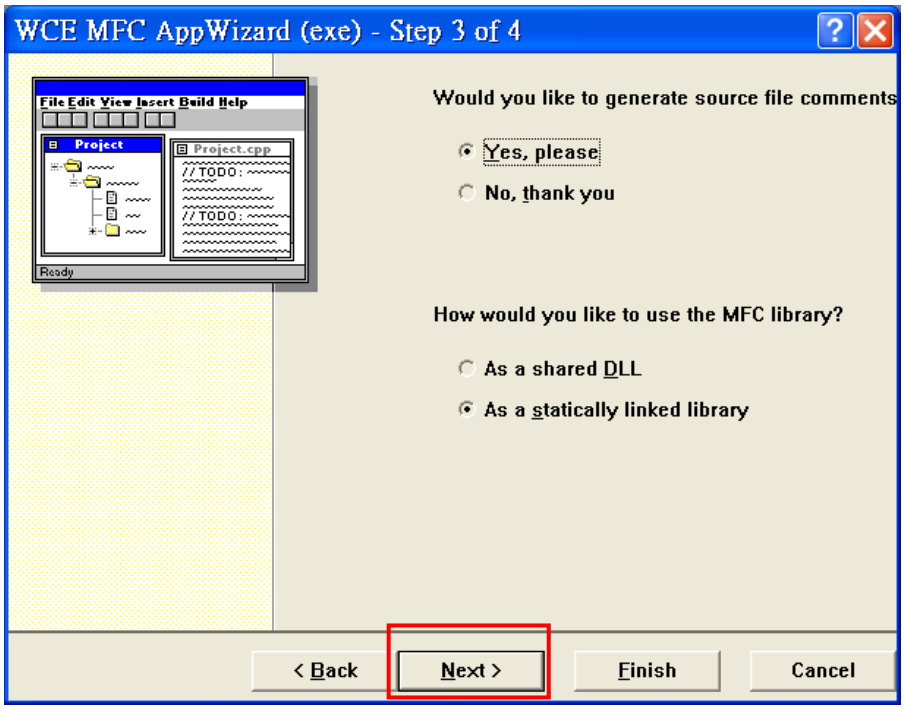
STEP 4: Select “Dialog based” and language setting. Click “Next” button.



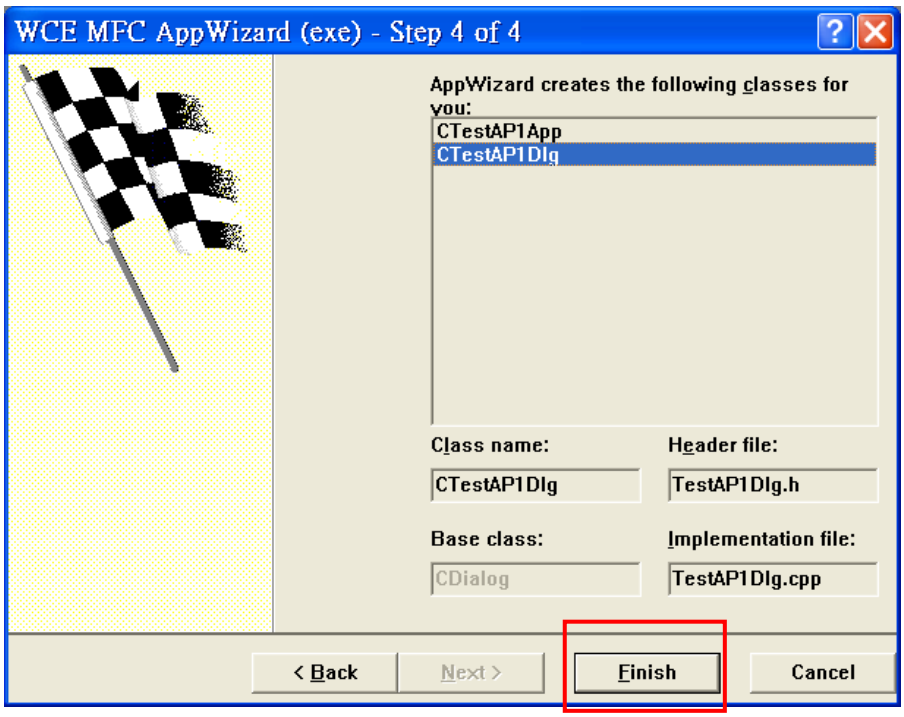
STEP 5: Click “Next” button.



STEP 6: Click “Next” button.



STEP 7: Click “Finish” button.



STEP 8: Now you can add your codes into this new project.

You can get more development information from below MSDN website.
http://msdn.microsoft.com/en-us/library/bb847963.aspx

3.3 Serial Port Function

3.3.1 Overview

There are 4 serial ports in BEGA220A. Below table lists the function of each serial port:

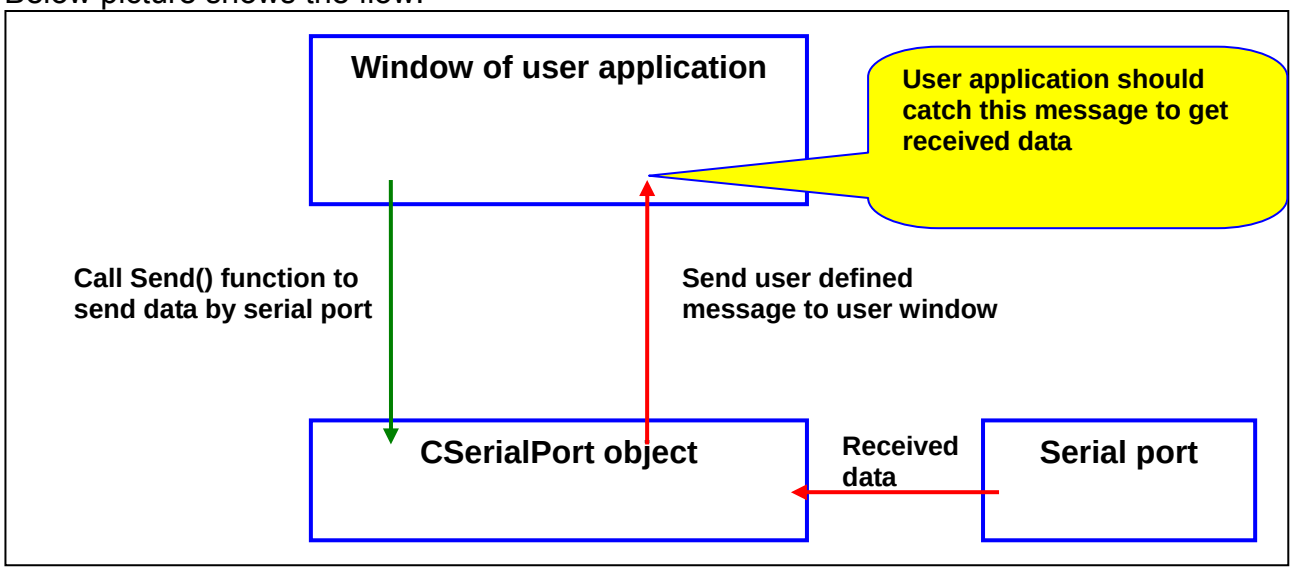
Name	Function	Comment
COM1:	RS422 or RS485 port	Option
COM3:	Used by application program.	2 wire RS232
COM4:	Used by application program.	2 wire RS232
Debug port	Internal used.	Could not open by application program.

3.3.2 Serial Port Control-CSerialPort class

Bolymin provided a class, CSerialPort, which implements basic control logic for serial port. Application could use this class by adding **"CSerialPort.cpp"** and **"CSerialPort .h"** into project. Customer could modify the source code of class CSerialPort to expand the serial port functions.

3.3.2.1 Basic concept of class CSerialPort

The object of class CSerialPort will handle all data transfer and receive of opened serial port. Once there is any data is received by the opened serial port, CSerialPort object will send a user defined message to user defined window which should be main window of application program. Below picture shows the flow:


Window of user application
User application should catch this message to get received data
Call Send() function to send data by serial port
Send user defined message to user window
CSerialPort object
Received data
Serial port

3.3.2.2 Member function of class CSerialPort

CSerialPort Function: Constructor function of calss CSerialPort.

Syntax	CSerialPort( );
Parameters	None
Return value	None

Open Function: Open a serial port.

Syntax	BOOL Open(LPCTSTR port, int baud_rate, int data_bit int stop_bit int parity);
Parameters	port Name of serial port listed in the table of section 3.3.1. baud_rate Baud rate, ex: 9600. data_bit Data_bit, 7 ~ 8 stop_bit Stop bit , ONESTOPBIT, ONE5STOPBITS or TWOSTOPBITS. parity Parity , NOPARITY, ODDPARITY, EVENPARITY.
Return value	TRUE: Open serial port successfully FALSE: .Open serial port fail.

Send Function: Send specified data by this serial port.

Syntax	BOOL Send(LPCVOID buf_ptr, DWORD data_len);
Parameters	buf_ptr Memory pointer of data will be sent. data_len Length of data will be sent. (UNIT: byte)
Return value	TRUE: Send data successful. FALSE: Send data fail.

SetCommMsg Function: CSerialPort object will send a receive message to specified window. User need to call this function to set the receive message value and the window that will receive message.

Syntax	void SetCommMsg(HWND win_handle, UINT receive_msg);
Parameters	win_handle Handle of the window that will receive message. receive_msg User defined message value.
Return value	None

Close Function: Close current serial port.

Syntax	BOOL Close ( );
Parameters	None
Return value	TRUE: Close serial port successfully. FALSE: Cloas serial port fail.

3.3.2.3 How to catch the receive message

Please follow below steps to catch the receive message.

STEP 1: Define a receive message in your code as below:

const UINT WM_CMD_OK = WM_USER+1;

STEP 2: Declare a message processing function in the window that will process receive message.

```
// Generated message map functions
//{{AFX_MSG(CSerialPortDlg)
virtual BOOL OnInitDialog();
afx_msg void OnOpenCom();
afx_msg void OnCloseCom();
afx_msg void OnSend();
afx_msg void OnClearSend();
afx_msg void OnClearRec();
afx_msg void OnDestroy();
afx_msg void OnCmdTest();
//}}AFX_MSG
afx_msg LRESULT OnCommRecv(WPARAM wParam, LPARAM lParam);
DECLARE_MESSAGE_MAP()
```

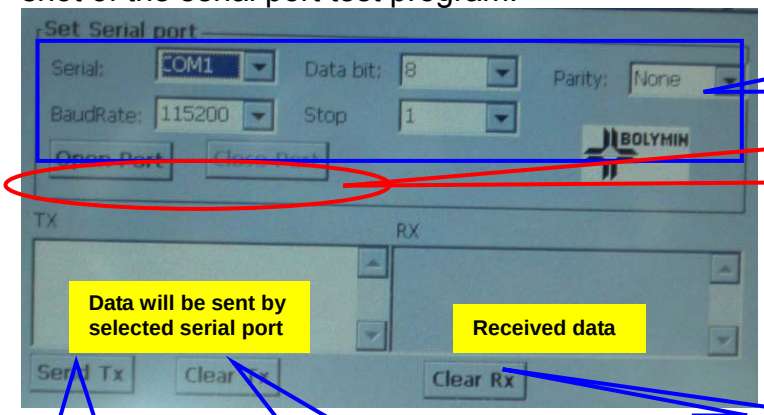
STEP 3: Create message mapping.

```
BEGIN_MESSAGE_MAP(CSerialPortDlg, CDialog)
    //{{AFX_MSG_MAP(CSerialPortDlg)
    ON_BN_CLICKED(IDC_OPEN_COM, OnOpenCom)
    ON_BN_CLICKED(IDC_CLOSE_COM, OnCloseCom)
    ON_BN_CLICKED(IDC_SEND, OnSend)
    ON_BN_CLICKED(IDC_CLEAR_SEND, OnClearSend)
    ON_BN_CLICKED(IDC_CLEAR_REC, OnClearRec)
    ON_BN_CLICKED(IDC_CMD_TEST, OnCmdTest)
    ON_WM_DESTROY()
    //}}AFX_MSG_MAP
    ON_MESSAGE(WM_CMD_OK, OnCommRecv)
END_MESSAGE_MAP()
```

STEP 4: Implement the receive message processing function.

3.3.3 Example Code

Bolymin provide a test application and its source code for example. Below picture is the screen shot of the serial port test program:



Select serial port and setup its parameter values.

Open/Close selected serial port.

Clear received data

Send data

Clear sent data.

Below are the major source codes of the test program:

File: SerialPortDlg.cpp

```
//////////////////////////////////////////////////////////////////////////
// CSerialPortDlg dialog
//////////////////////////////////////////////////////////////////////////
```

Define a receive message

```
const UINT WM_CMD_OK = WM_USER+1;

BEGIN_MESSAGE_MAP(CSerialPortDlg, CDialog)
    //{{AFX_MSG_MAP(CSerialPortDlg)
    ON_BN_CLICKED(IDC_OPEN_COM, OnOpenCom)
    ON_BN_CLICKED(IDC_CLOSE_COM, OnCloseCom)
    ON_BN_CLICKED(IDC_SEND, OnSend)
    ON_BN_CLICKED(IDC_CLEAR_SEND, OnClearSend)
    ON_BN_CLICKED(IDC_CLEAR_REC, OnClearRec)
    ON_WM_DESTROY()
    //}}AFX_MSG_MAP
    ON_MESSAGE(WM_CMD_OK, OnCommRecv)

END_MESSAGE_MAP()
//////////////////////////////////////////////////////////////////////////
// CSerialPortDlg message handlers
//////////////////////////////////////////////////////////////////////////
```

Map the receive message processing function to user defined message.

```
BOOL CSerialPortDlg::OnInitDialog()
{
	CDialog::OnInitDialog();

	// Set the icon for this dialog.  The framework does this automatically
	//  when the application's main window is not a dialog
	SetIcon(m_hIcon, TRUE);			// Set big icon
	SetIcon(m_hIcon, FALSE);		// Set small icon

	CenterWindow(GetDesktopWindow());	// center to the hpc screen
	m_ComboBaud.SetCurSel(5);		/* Define BaudRate: 115200 */
	m_ComboData.SetCurSel(1);		/* Define data bit: 8 bit */
	m_ComboParity.SetCurSel(0);		/* Define parity: none */
	m_ComboPort.SetCurSel(0);		/* Define searial port: COM1 */
	m_ComboStop.SetCurSel(0);		/* Define stop bit: 1bit */

	m_ButClose.EnableWindow(FALSE);		/* "Close"Button is disable*/
	m_strRecDisp = _T("");
	m_cSendBuffer = new char[60];
	UpdateData(FALSE);

	m_pSerialPort = new CSerialPort();
	m_pSerialPort->SetCommMsg(m_hWnd, WM_CMD_OK);
	return TRUE;
}
/*************************************************************************************************
Implement function used to process receive data from serial port
*************************************************************************************************/
LRESULT CSerialPortDlg::OnCommRecv(WPARAM wParam, LPARAM lParam)
{
	CString tmp;
	char *buf;
	DWORD buflen;

	buf = (char *)wParam;		// memory pointer of received data
	buflen = (DWORD)lParam;		// received data length

	CEdit *pRecvStrEdit = (CEdit*)GetDlgItem(IDC_REC_DISP);

	for (int i = 0; i < buflen; i++, buf++)
```

Create a CSerialPort object and set current window as the window which will process received data.

```
    {
        tmp.Format(_T("%c"), *buf);
        m_strRecDisp += tmp;
    }

    pRecvStrEdit->SetWindowText(m_strRecDisp);      /* Show */
    return 0;
}

// Initial user interface
const CString PorTbl[4] = {_T("COM1:"),_T("COM3:"),_T("COM4:"),_T("COM6:")};
const DWORD BaudTbl[6] = {4800, 9600, 19200, 38400, 57600,115200};
const DWORD DataBitTbl[2] = {7, 8};
const BYTE    StopBitTbl[3] = {ONESTOPBIT, ONE5STOPBITS, TWOSTOPBITS};
const BYTE    ParityTbl[4] = {NOPARITY, ODDPARITY, EVENPARITY, MARKPARITY};

/*********************************************************************************************
Function for “OPEN” button used to open selected serial port.
*********************************************************************************************/
void CSerialPortDlg::OnOpenCom()
{
    UpdateData(TRUE);

    CString strPort = PorTbl[m_ComboPort.GetCurSel()];
    DWORD baud   = BaudTbl[m_ComboBaud.GetCurSel()];
    DWORD databit = DataBitTbl[m_ComboData.GetCurSel()];
    BYTE stopbit     = StopBitTbl[m_ComboStop.GetCurSel()];
    BYTE parity      = ParityTbl[m_ComboParity.GetCurSel()];

    BOOL ret = m_pSerialPort->Open(strPort, baud, databit, stopbit, parity);
    if (ret == FALSE)
    {
        MessageBox(_T("Open ") + strPort + _T(" Fail!"));
        return;
    }

    m_ButOpen.EnableWindow(FALSE);          /* Disable "open" button    */
    m_ButClose.EnableWindow(TRUE);          /* Enable "close" button    */
    MessageBox(_T("Open ") + strPort + _T(" is OK!"));
}
```

Open selected serial port by specified parameter values.

```
/*********************************************************************************************
Function for “CLOSE” button used to close current serial port.
*********************************************************************************************/
void CSerialPortDlg::OnCloseCom()
{
    m_pSerialPort->Close();

    m_ButOpen.EnableWindow(TRUE);          /* Enable "Open" button */
    m_ButClose.EnableWindow(FALSE);        /* Disable "close" button    */
}

/*********************************************************************************************
Function for “SEND” button used to send data by serial port.
*********************************************************************************************/
void CSerialPortDlg::OnSend()
{
    UpdateData(TRUE);

    int len = m_strSendEdit.GetLength();

    for(int i = 0; i < len;i++)
        m_cSendBuffer[i] = (char)m_strSendEdit.GetAt(i);;

    BOOL status = m_pSerialPort->Send(m_cSendBuffer, len);
    if (!status)
        MessageBox(_T("Can't write string to COM"),_T("Error"),MB_OK);
}

/*********************************************************************************************
Destory function of serial port test dialog
*********************************************************************************************/
void CSerialPortDlg::OnDestroy()
{
    CDialog::OnDestroy();

    m_pSerialPort->Close();
    delete m_pSerialPort;
    delete m_cSendBuffer;
}
```

Close current serial port.

Send data by current serial port.

Close current serial port and delete CSerialPort object.

3.4 GPIO Control

3.4.1 How to Control GPIO for BEGA220A

Bolymin provides a DLL file "**pGPIO_220A.dll**" to control the General Purpose Input and Ouput(GPIO) signal. In BEGA220A, there are 12 user defined GPIO. User could read current value of all GPIO of BEGA220A, change values of GP output signal and set the attribute of GPIO by functions in "**pGPIO_220A.dll**".

User could use GPIO control functions by following procedures:
STEP 1. Add **"pGPIO_220A.h"** into project.

STEP 2. Load "**pGPIO_220A.dll**" by "**Loadlibrary**()" function.

STEP 3. Get the address of control functions by "**GetProcAddress**()" function.

STEP 4. Execute GPIO control functions by the address got at STEP3.

Below is a simple example code to use the GPIO control functions:

```
// variable declaration
HINSTANCE m_hModule;
BOOL (*m_pGetGPInput)(int);
void (*m_pSetGPOutput)(int, BOOL);
BOOL (*m_pIsOutput)(int);
void (*m_pSetIOAttribute)(int, BOOL);

m_hModule=::LoadLibrary(_T("pGPIO_220A.dll"));
m_pGetGPInput = (BOOL (*)(int))::GetProcAddress(m_hModule,_T("GetGPInput"));
m_pSetGPOutput = (void (*)(int, BOOL))::GetProcAddress(m_hModule,_T("SetGPOutput"));
m_pIsOutput = (BOOL (*)(int))::GetProcAddress(m_hModule,_T("IsOutput"));
m_pSetIOAttribute = (void (*)(int, BOOL))::GetProcAddress(m_hModule,_T("SetIOAttribute"));

m_pSetIOAttribute(GIO_KEY1, GA_INPUT);
m_bPOUT1 = m_pGetGPInput(GIO_KEY1);
m_pSetIOAttribute(GIO_KEY1, GA_OUTPUT);
if (m_pIsOutput(GIO_KEY1))
    m_pSetGPOutput(GIO_KEY1, TRUE);
```

Load "**pGPIO_220A.dll**" and get the address of GPIO control functions.

Execute GPIO control functions.

3.4.2 GPIO Control Function for BEGA220A

GetGPInput Function: Get current status of specified GPIO.

Syntax	BOOL GetGPInput (int gpio_index);
Parameters	gpio_index The index of specified GPIO. Refer to section 3.4.3 for the value definition.
Return value	TRUE: Current status of specified GPIO is HIGH. FALSE: Current status of specified GPIO is LOW.

SetGPOutput Function: Set value of specified GP Output.

Syntax	void SetGPOutput (int gpio_index, BOOL value);
Parameters	gpio_index The index of specified GP output. Refer to section 3.4.3 for the value definition. value New value of specified GP output. TRUE: Set specified GP output to HIGH. FALSE: Set specified GP output to LOW.
Return value	None

IsOutput Function: Check if the specified GPIO is output or not..

Syntax	BOOL IsOutput (int gpio_index);
Parameters	gpio_index The index of specified GPIO. Refer to section 3.4.3 for the value definition.
Return value	TRUE: The specified GPIO is output. FALSE: The specified GPIO is input.

SetIOAttribute Function: Set the attribute of the specified GPIO.

Syntax	void SetIOAttribute (int gpio_index, BOOL value);
Parameters	gpio_index The index of specified GPIO. **GIO_KEY1~GIO_KEY12**. value New attribute of the specified GPIO. GA_OUTPUT: Set the specified GPIO as output. GA_INPUT: Set the specified GPIO as input.
Return value	None

3.4.3 Definition of GPIO Index

Class CGPIO_220A support following index values:

GPIO index	Description
GIO_KEY1	User defined general purpose input/output. (KEY1)
GIO_KEY2	User defined general purpose input/output. (KEY2)
GIO_KEY3	User defined general purpose input/output. (KEY3)
GIO_KEY4	User defined general purpose input/output. (KEY4)
GIO_KEY5	User defined general purpose input/output. (KEY5)
GIO_KEY6	User defined general purpose input/output. (KEY6)
GIO_KEY7	User defined general purpose input/output. (KEY7)
GIO_KEY8	User defined general purpose input/output. (KEY8)
GIO_KEY9	User defined general purpose input/output. (KEY9)
GIO_KEY10	User defined general purpose input/output. (KEY10)
GIO_KEY11	User defined general purpose input/output. (KEY11)
GIO_KEY12	User defined general purpose input/output. (KEY12)
GO_BLIGHT_ENABLE	Backlight control. Default value : **HIGH**.
GO_LCD_POWER_ENABLE	LCD power control. Default value : **LOW**.
GO_AMP_SWITCH	Amplifier switch. Default vale: **LOW**.
GO_EN485	Reserved for internal use.

3.5 ADC Converter and Backlight Adjustment

3.5.1 Overview

Bolymin provides a dynamic link library "**CtrlFunc_220A.dll**" which includes all control functions of A/D converter and backlight adjustment.
For A/D converter, there are 6-ch A/D converters with 12-bit resolution in BEGA220A. User could read the value from selected A/D converter channel by functions provided by Bolymin. Suggested hardware wiring about A/D converter could be found in user manual. Detail description of control functions of A/D converter could be found in section 3.5.2.
For backlight adjustment, user could get current brightness value or change the brightness of backlight by control functions. The description of control functions of backlight adjustment could be found in section 3.5.3.

User could use control functions about A/D converter and backlight adjustment by following procedures:
STEP 1. Add **"CtrlFunc_220A.h"** into project.
STEP 2. Load "**CtrlFunc_220A.dll**" by "**Loadlibrary**()" function.
STEP 3. Get the address of control functions by "**GetProcAddress**()" function.
STEP 4. Execute control functions about A/D converter by the address got at STEP3.
STEP 5. Call **"FreeLibrary()"** function to free the reference of "**CtrlFunc_220A.dll**" while ending the application program.

Below is a simple example code to use the control functions about A/D converter and backlight adjustment:

```
// variable declaration
HINSTANCE m_hModule;
BOOL (*m_pInitADC)(void);
int (*m_pReadADC)(int);

m_hModule=::LoadLibrary(_T("CtrlFunc_220A.dll"));
m_pInitADC = (BOOL (*)(void))::GetProcAddress(m_hModule,_T("InitADC"));
m_pReadADC = (int (*)(int))::GetProcAddress(m_hModule,_T("ReadADC"));
m_pInitBacklightCtrl = (BOOL (*)(void))::GetProcAddress(m_hModule,_T("InitBacklightCtrl"));
m_pGetBrightness = (int (*)(void))::GetProcAddress(m_hModule,_T("GetBrightness"));
m_pSetBrightness = (int (*)(int))::GetProcAddress(m_hModule,_T("SetBrightness"));

m_pInitADC();
value = m_pReadADC(ADC_CHANNEL0);

m_pInitBacklightCtrl();
brightness = m_pGetBrightness();
m_pSetBrightness(brightness+5);  // Increase the brightness by 5
m_pSetBrightness(0);             // OFF the backlight

FreeLibrary(m_hModule);          // free the reference of "CtrlFunc_220A.dll"
```

Load "**CtrlFunc_220A.dll**" and get the address of control functions.

Execute control functions of A/D converter.

Execute control functions of backlight adjustment.

3.5.2 Control Function of A/D Converter

nitADC Function: A/D converter initialization. **User need to call this function before using A/D converter.**

Syntax	BOOL initADC ( );</br>
Parameters	None
Return value	TRUE: Initial A/D converter successfully. FALSE: Fail to initial A/D converter.

ReadADC Function: Read A/D converted data from specified A/D converter channel.

Syntax	Int ReadADC(int adc_channel);
Parameters	adc_channel The index of specified A/D converter channel. **ADC_CHANNEL0~ADC_CHANNEL5**
Return value	A/D converted data from specified A/D converter channel.

3.5.3 Function about Backlight Adjustment

InitBacklightCtrl Function: Initial backlight controller. **User need to call this function before adjusting backlight brightness.**

Syntax	BOOL InitBacklightCtrl ( );</br>
Parameters	None
Return value	TRUE: Initial backlight controller successfully. FALSE: Fail to initial backlight controller.

GetBrightness Function: Get current brightness value of backlight.

Syntax	int GetBrightness ( );</br>
Parameters	None
Return value	Current brightness value of backlight. (0~100)

SetBrightness Function: Set brightness value of backlight.

Syntax	Int SetBrightness(int new_value);</br></br>
Parameters	new_value New brightness value of backlight. (0~100) **0: Turn OFF the backlight**
Return value	Original brightness value of backlight.